

## LEED Certified Buildings in Seattle: *Analysis & Projections*

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Prepared for:

Seattle Pubic Utilities



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## Study of LEED Certified Buildings in Seattle

Seattle Public Utilities

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## **Background**

Most owners view their LEED plaque as the culmination of the LEED process - once it's completed, they pay little attention to the documentation used to prepare the application. But this documentation contains a wealth of information for anyone who manages a large cohort of buildings or who delivers sustainability programs meant to serve them. In an attempt to better understand the sustainable features being implemented, the City of Seattle engaged Paladino and Company to conduct a study of the first 15 LEED-certified buildings within its city limits. This study “mined” the LEED documentation for these buildings to develop profiles of the water, energy and solid waste measures they incorporated.

Within the Seattle City limits there are 15 LEED certified projects and over 30 projects registered for certification (as of September 2005). The objective of this study is to evaluate the long term impacts of these innovative new buildings on the City's infrastructure and resources.

Seattle Public Utilities is interested in tracking the projected savings for LEED credits that impact the City utilities. The goals of the study are to:

- ☐ Understand the LEED credit performance of Seattle buildings relative to the national average credit achievement.
- ☐ Identify the most commonly implemented sustainable design strategies and project their future impact on City service infrastructure.
- ☐ Identify sustainability opportunities that are not currently being aggressively addressed by Seattle buildings. This information may then be used to shape future City programs.

## **Methodology**

LEED application documentation data was collected for all 15 LEED Certified Projects in Seattle as of September 2005. The final LEED documentation for these projects was collected from the design teams and analyzed for the purpose of the study. The results of the study and the credit analysis are based on the LEED documents that the design teams submitted to the USGBC for LEED certification of their projects. This data may not be representative of the actual building performance.

## **Scope**

The data has been compiled for each credit and may be used in several different ways. Within the scope of this project the study does the following:

- ☐ Analyzes the trends in LEED credit achievement
- ☐ Identifies the key strategies implemented by projects to achieve LEED credits
- ☐ Projects the existing trends to the future new commercial construction in Seattle

The credits studied fall into the categories of Sustainable Sites, Water Efficiency, Materials & Resources and Energy & Atmosphere. The LEED documentation for the following credits was used for the analysis:

1. Sustainable Sites credit 6, *Stormwater Management*
2. Water Efficiency credit 1, *Water Efficient Landscaping*
3. Water Efficiency credit 2, *Innovative Waste Water Technologies*
4. Water Efficiency credit 3, *Water Use Reduction*
5. Material & Resources credit 1, *Building Reuse*
6. Material & Resources credit 2, *Construction Waste Management*
7. Material & Resources credit 3, *Resource Reuse*
8. Material & resources credit 4, *Recycled Content*
9. Energy & Atmosphere credit 1, *Optimize Energy Performance*
10. Energy & Atmosphere credit 2, *Renewable Energy*
11. Energy & Atmosphere credit 7, *Green Power*

### LEED Certified Projects in Seattle

Within the Seattle City limits there are 15 LEED certified projects: 11 projects certified as per the LEED New Construction and Major Renovation Rating System (LEED NC), 2 certified as per LEED for Commercial Interiors Rating System (LEED CI), 1 certified as per LEED for Core and Shell Rating System (LEED CS) and 1 certified as per LEED for Existing Buildings Rating System (LEED EB). Figure 1 illustrates the level of certification (Certified, Silver, Gold or Platinum) for the LEED certified projects in Seattle.

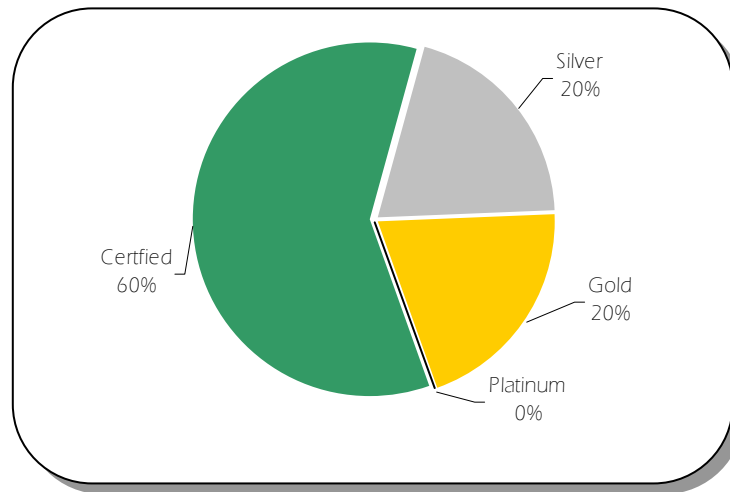


Figure 1 LEED Rating Achievement Level for LEED Certified Projects in Seattle (As of September 2005)

### Seattle LEED Projects vs. US National LEED Projects

LEED rated buildings represent the leading edge of sustainable design, and analyzed as an aggregate, their LEED documentation provides valuable information. An analysis of the most common credits achieved and how they compare to US averages (or averages for other regions or building types) gives information about the most accessible sustainability measures for Seattle.

Figure 2 compares the credit achievement trends for Seattle to the US national average. Positive and negative variance of greater than 15% for LEED credit achievement has been indicated. The LEED certified projects in Seattle exceed the national average credit achievement by 15% or more for the following credits:

- ☐ Sustainable Sites credit 1, *Site Selection*
- ☐ Sustainable Sites credit 2, *Development Density*
- ☐ Sustainable Sites credit 4.1, *Alternative Transportation, Public Transportation Access*
- ☐ Materials & Resources credit 2, *Construction Waste Management*
- ☐ Materials & Resources credit 5.2, *Local & Regional Materials (10% Extracted Regionally)*
- ☐ Indoor Environmental Quality credit 3, *Construction IAQ Management Plan*

The LEED certified projects in Seattle performed less than the national average credit achievement by 15% or more for the following credits:

- ☐ Sustainable Sites credit 4.4, *Alternative Transportation, Parking Capacity*
- ☐ Sustainable Sites credit 6.2, *Stormwater Management, Rate & Quantity*
- ☐ Water Efficiency credit 1.2, *Water Efficient Landscaping No potable Use or No Irrigation*
- ☐ Water Efficiency credit 3.2, *Potable Water Use, 30% Reduction*
- ☐ Materials & Resources credit 4, *Recycled Content 10%*
- ☐ Indoor Environmental Quality credit 1, *CO<sub>2</sub> Monitoring*
- ☐ Indoor Environmental Quality credit 2, *Increase Ventilation Effectiveness*
- ☐ Indoor Environmental Quality credit 4.1, *Low Emitting Materials, Adhesives & Sealants*
- ☐ Indoor Environmental Quality credit 4.1, *Low Emitting Materials, Composite Wood*

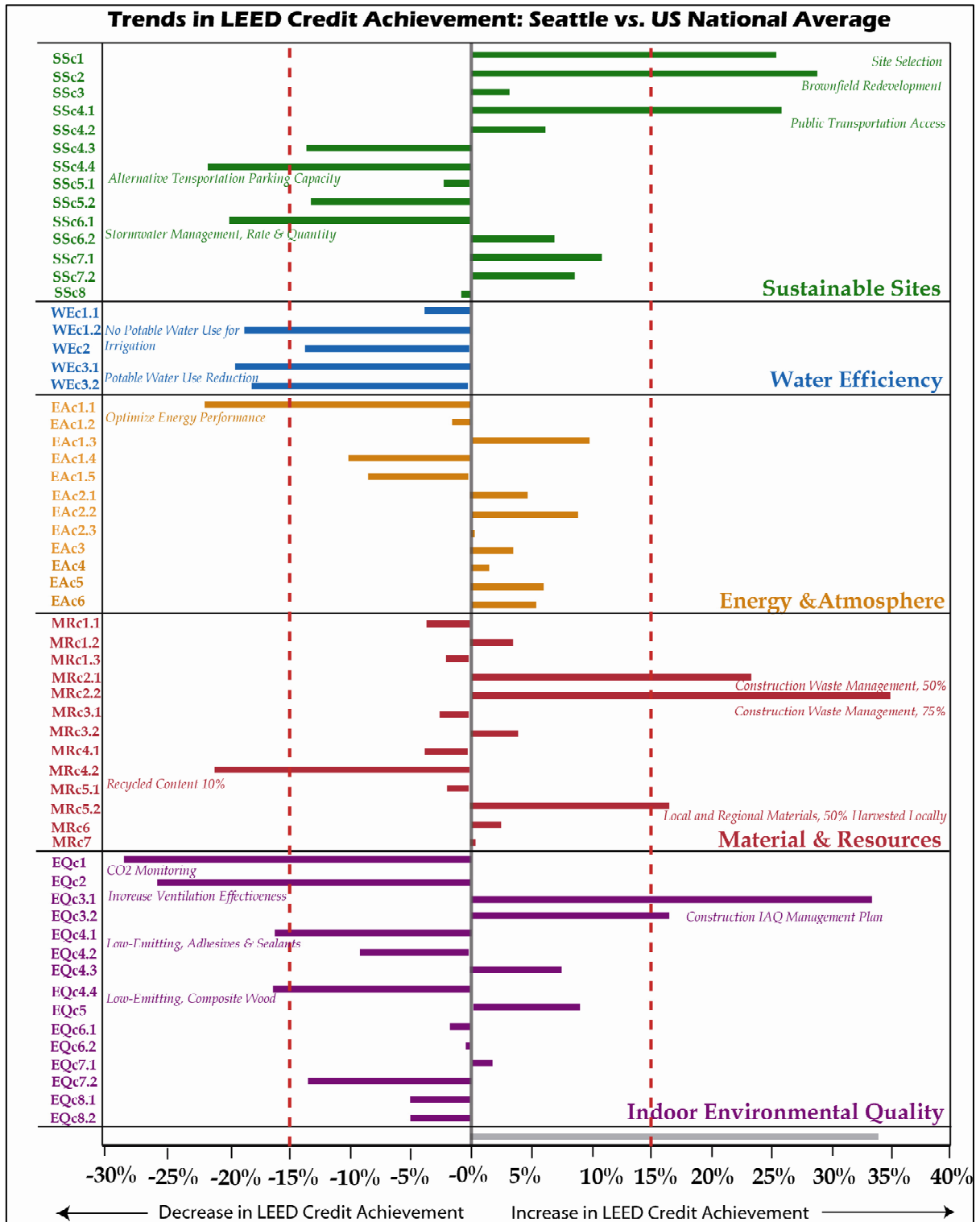


Figure 2 Comparison of LEED NC Credit Achievement for Seattle and US national data



## Report Structure

This report has been divided into three sections:

### Section 1 - Introduction

This describes the project and provides an overall comparison of Seattle buildings to the US national average.

### Section 2 – Credit Summary

A credit-by-credit analysis highlights the key findings for each of the credits studied and provides the back up data on which the results are based. These are the credit summary (81/2 x 11) sheets. Each credit analysis includes the following:

- ☐ Strategy Benefits: This broadly describes the expected benefits of meeting the credit requirements and achieving them.
- ☐ Achievement Level: This describes the percentage of LEED certified projects in Seattle that achieved the credit and the associated environmental savings. (e.g.: Annual Water Use Reduction in gallons)
- ☐ Key Strategies: The key strategies are the ones most commonly implemented by the projects in the City.
- ☐ Projected Future Benefits: Based on the information documented in the City of Seattle Comprehensive Plan that forecasts future growth in jobs and households, the trends in the LEED credit achievement have been extrapolated to the annual future commercial construction in Seattle. These benefits are based on the LEED credit documentation information (building energy simulations, water use calculations, etc.) submitted to the USGBC and may not be representative of the actual performance of the buildings.

### Section 3 – Credit Data Analysis Sheets

For each of the credits the report includes a data sheet (11 x 17) compilation of credit information. The datasheet provided can be used in different ways to extract useful information about green building trends in Seattle.

## Projected Benefits Assumptions

The projection of future benefits has been done for LEED credits that have been achieved by a significant number of LEED rated projects in Seattle. These credits are:

- ☐ Material & resources credit 2, *Construction Waste Management*
- ☐ Water Efficiency credit 3, *Potable Water Use Reduction*
- ☐ Energy & Atmosphere credit 1, *Optimize Energy Performance*

The projected future benefits assumptions are based on the following sources of information:

- ❑ **Forecasts used for the Seattle Comprehensive Plan 2004**  
The City forecasts future growth in jobs and households based on a percentage of the regional growth. This forecast information in the Comprehensive Plan is approved by the Mayor's Office and City Council and sent to the State as part of the requirements under the Growth Management Act. For the purpose of this study the numbers forecasted have been averaged out to project annual new construction in Seattle.
- ❑ **Trend Analysis for existing LEED certified projects in Seattle**  
Existing trends for the level of credit achievement were studied for the LEED certified projects in Seattle and the achievement level averages demonstrated are based on the number of projects and not the square footage of construction. Also, the % of LEED certified projects that achieved the credit has been factored in to evaluate the benefits of LEED certified future commercial construction.
- ❑ **Assumptions for LEED Certification of Buildings**  
The percentages of future new commercial construction in Seattle that will achieve a LEED rating are listed in Table 1 below. The assumptions were developed by SPU for use in this analysis and used to estimate the average annual LEED certified future new construction in Seattle.

## Future Work

LEED rated buildings represent the leading edge of sustainable design, and analyzed as an aggregate, their LEED documentation provides valuable information. An analysis of the most common credits achieved and how they compare to US averages (or averages for other regions or building types) gives information about the most accessible sustainability measures for a given region or cohort of buildings. Digging deeper, an analysis of the measures used to achieve individual credits illustrates the successful market penetration of specific strategies and also opportunities lost. The results of these analyses provide useful insights into the existing state of sustainable design/construction practices and can be used to shape future codes and incentive programs.

Comparisons of different cities, regions, or building types can reveal the sustainable building profile for each individual cohort of buildings. Differences in the credits achieved and measures implemented can reflect differences in regional codes, standard building practices, regional or building-type priorities, incentive programs available, etc. These profiles can also be tracked through time to demonstrate changes in sustainable building priorities. They may also point out business opportunities for industries & services that are not available in the region to encourage or support seldom-achieved credits and measures.

Table 1

### Projected Annual New Commercial Construction in Seattle<sup>1</sup>

Area	SF per Job	Area (SF)	# Jobs
Downtown Urban Center	275	398,956	1451
Manufacturing/Industrial Center	450	252,875	562
All Other Areas	300	646,275	2154
		1,298,106	4167

### Projected Data for Commercial New Construction and LEED NC Projects in Seattle

	Annual SF of Commercial Construction	Cumulative SF of Commercial Construction	Annual # Jobs <sup>2</sup>	% Commercial New Const. Adopting LEED	Annual SF of LEED Commercial Construction	Annual FTE for LEED Projects	Cumulative SF of LEED Commercial Construction	Cumulative FTE for LEED Projects
<b>Current <sup>3</sup></b>	na	na	na	na	na	na	1,822,992	2,878
<b>2006</b>	1,298,106	1,298,106	4,167	5%	64,905	208	1,887,897	3,086
<b>2007</b>	1,298,106	2,596,213	8,334	8%	97,358	625	1,985,255	3,399
<b>2008</b>	1,298,106	3,894,319	12,501	10%	129,811	1,250	2,115,066	3,816
<b>2009</b>	1,298,106	5,192,425	16,668	13%	162,263	2,083	2,277,329	4,337
<b>2010</b>	1,298,106	6,490,531	20,835	15%	194,716	3,125	2,472,045	4,962
<b>2011</b>	1,298,106	7,788,638	25,002	18%	227,169	4,375	2,699,214	5,691
<b>2012</b>	1,298,106	9,086,744	29,169	20%	259,621	5,834	2,958,835	6,524
<b>2013</b>	1,298,106	10,384,850	33,336	23%	292,074	7,501	3,250,909	7,462
<b>2014</b>	1,298,106	11,682,956	37,503	25%	324,527	9,376	3,575,435	8,504
<b>2015</b>	1,298,106	12,981,063	41,669	28%	356,979	11,459	3,932,415	9,650
<b>2016</b>	1,298,106	14,279,169	45,836	30%	389,432	13,751	4,321,847	10,900
<b>2017</b>	1,298,106	15,577,275	50,003	33%	421,885	16,251	4,743,731	12,254
<b>2018</b>	1,298,106	16,875,381	54,170	35%	454,337	18,960	5,198,068	13,712
<b>2019</b>	1,298,106	18,173,488	58,337	38%	486,790	21,876	5,684,858	15,275
<b>2020</b>	1,298,106	19,471,594	62,504	40%	519,243	25,002	6,204,101	16,942
<b>2021</b>	1,298,106	20,769,700	66,671	43%	551,695	28,335	6,755,796	18,713
<b>2022</b>	1,298,106	22,067,806	70,838	45%	584,148	31,877	7,339,944	20,588
<b>2023</b>	1,298,106	23,365,913	75,005	48%	616,600	35,627	7,956,544	22,567
<b>2024</b>	1,298,106	24,664,019	79,172	50%	649,053	39,586	8,605,597	24,650

<sup>1</sup> Based on Information obtained from the Comprehensive Plan (2004-2024) for City of Seattle

<sup>2</sup> Based on Average Sqaure Foot per job

<sup>3</sup> Based on the 11 LEED NC Certified Projects in Seattle

## SSc6.1 Stormwater Management, Rate & Quantity

### Credit Requirements

Stormwater run off from urban areas contains sediment and other contaminants that have a negative impact on water quality, navigation and recreation. The intent of this LEED credit is to minimize the stormwater run-off from areas that are constructed and urbanized. For the City the potential benefits are a reduction in the volume of stormwater that the municipal infrastructure has to handle for its conveyance and treatment.

This credit requires projects with a net site imperviousness area greater than 50% to reduce post-development stormwater run off from the site by 25% as compared to the pre-development conditions. For sites where existing net imperviousness is less than 50%, projects are required to ensure that post-development stormwater run off does not exceed the pre-development run off.

### Achievement Level

20% of the LEED Certified projects in Seattle have achieved this credit. The estimated total annual decrease in stormwater run off for these projects is 1,612,715 gallons and the average percentage reduction in stormwater run off achieved by these projects is 39%, significantly exceeding the 25% requirement for this credit.

### Key Strategies

The LEED documentation indicates that 66% of the buildings that achieved this credit had net site imperviousness greater than 50% and implemented strategies to reduce the rate and quantity of stormwater runoff by a minimum of 25%. The key strategies implemented to accomplish this credit are shown in Figure 3.

### Key Findings

- ❑ 20% projects achieved the credit (3 of 15)
- ❑ 39% average stormwater run-off reduction
- ❑ Approximately 1.6 million gallons of stormwater run-off diverted from City's municipal infrastructure
- ❑ All of the projects that achieved the credit implemented a rainwater collection and reuse strategy.

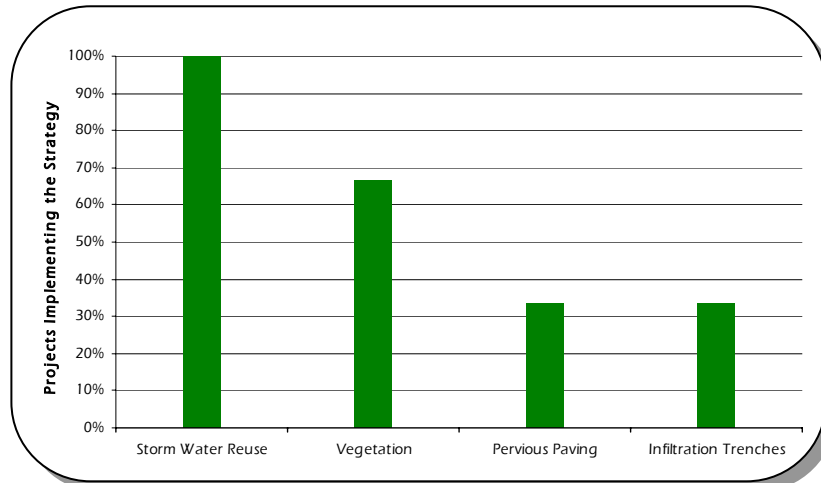


Figure 3 Key Strategies Implemented to achieve SSc6.1 by LEED Certified projects in Seattle.

### **Projected Future Benefits**

Trends indicate that 20% of LEED certified projects achieve this credit and these projects on an average reduce stormwater runoff by 39 %.

Therefore, successful achievement of this credit by future new construction LEED Certified projects in Seattle will account for up to 8% reduction in stormwater runoff that would have gone to the stormwater sewer.

## SSc6.2 Stormwater Management, Treatment

### Credit Requirements

The intent of this credit is to limit the disruption of natural water flows by eliminating the contaminants in stormwater runoff before it leaves the site to reduce pollution of the receiving water bodies. The credit requires projects to remove 80% of the average annual post-development total suspended solids (TSS) and 40% of the average annual post-development total Phosphorous (TP) based on the average annual loadings from all storms less than or equal to the 2-year/24-hour storm.

### Achievement Level

33% of LEED Certified projects in Seattle achieved this credit.

### Key Strategies

The key strategies included infiltration trenches, bioswales and filtration in detention tanks.

#### Key Findings

- ❑ 33% of LEED certified projects achieved this credit.
- ❑ Key Strategies implemented to treat stormwater on site are infiltration trenches, wet vault and bioswales.

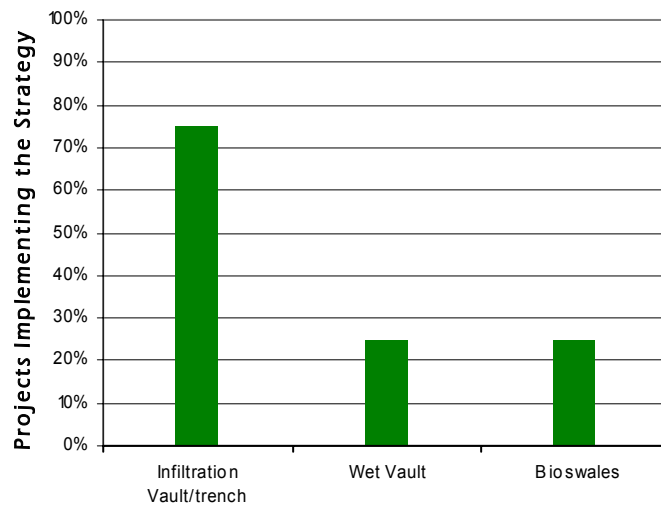


Figure 4 Key Strategies Implemented to achieve SSc6.2 by LEED Certified projects in Seattle.

### Projected Future Benefits

Successful achievement of this credit by future projects in Seattle will result in improved watershed quality and minimize the need for stormwater infrastructure.

## WEc1 Water Efficient Landscaping

### Credit Requirements

Potable water is typically used for landscaping irrigation and for all plumbing fixtures within a building. Innovative landscape design, water collection practices and drought tolerant plants can drastically reduce or even eliminate the use of potable water for irrigation.

To achieve WEc1.1, a project must reduce its irrigation water use by at least 50% compared to conventional design. For WEc1.2, projects must use no potable water for irrigation purposes (100% reduction).

### Achievement Level

73% of the LEED Certified projects in Seattle have achieved WEc1.1 and reduced potable water use for irrigation by at least 50%. Half of the projects have gone further to achieve WEc1.2 and completely eliminated the use of potable water consumption for irrigation. The average irrigation water use savings for the entire group of projects achieving these credits is 83%.

### Key Strategies

The key strategies implemented by the projects to accomplish this credit are:

- ☐ Use of native plants
- ☐ Rainwater harvesting
- ☐ No Irrigation
- ☐ Water efficient irrigation technology

### Key Findings

- ☐ 73% of LEED certified projects reduced water use for irrigation by 50%
- ☐ 47% of the projects that achieved this credit eliminated all water use for irrigation
- ☐ Average potable water use reduction for irrigation achieved by the projects that achieved this credit is 83%

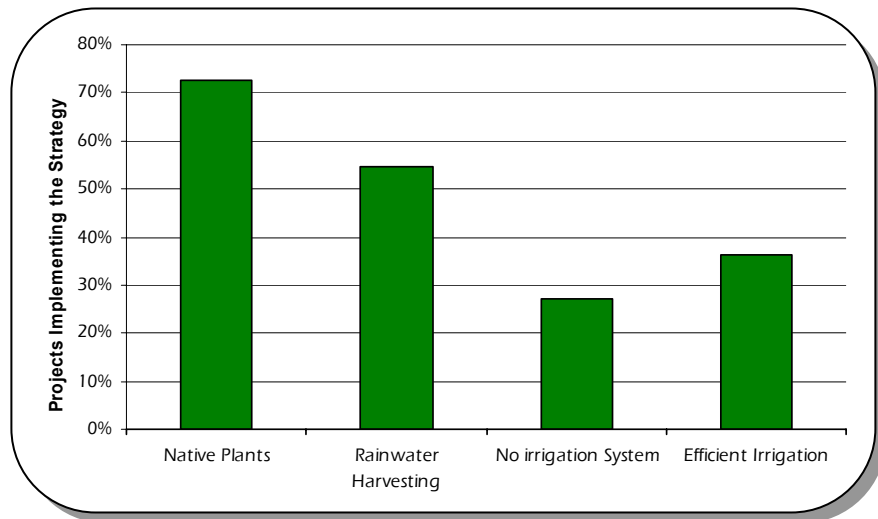


Figure 5 Key Strategies Implemented to achieve WEc1 by LEED Certified projects in Seattle.

### **Projected Future Benefits**

Trends indicate that 71% of LEED certified projects successfully achieve this credit and on an average save 83% of potable water used for irrigation. Future LEED projects in Seattle will account for up to 59% reduction in potable water consumption for irrigation.



## WEc2 Innovative Wastewater Technologies

### Credit Requirements

#### Key Findings

- ❑ *13% of LEED certified projects achieved the credit*
- ❑ *Total Annual wastewater reduction for projects implementing this strategy is 1.4 million gallons.*

Conventional wastewater systems require significant volumes of water to convey waste to the municipal wastewater treatment facilities. The intent of this credit is to reduce the generation of waste water and potable water demand by reducing the quantity of potable water required for toilets and urinals and/or by substituting non-potable water for these purposes. For example, collected rainwater or greywater volumes can be treated on site and reused to flush toilets and urinals. Benefits for the City include a reduction in the volume of stormwater that the municipal infrastructure has to handle for its conveyance and treatment and reduced potable water demand.

Achievement of this credit requires a 50% reduction in potable water used for sewage conveyance or the treatment of all wastewater on site to tertiary standards.

### Achievement Level

13% of LEED Certified projects (2 out of 15) in Seattle achieved this credit. The key strategy implemented was greywater reuse. This strategy reduced wastewater generated annually by 1.4 million gallons.

### Key Strategies

The key strategies implemented by the LEED certified projects in Seattle to accomplish this credit are greywater reuse for toilets and irrigation.

### Projected Future Benefits

Only one out of the 15 projects achieved this credit. This is too few to support a future projection. However, implementation of this strategy can result in a significant decrease in wastewater volumes generated by the City. It would be interesting to evaluate the benefits of this wastewater reduction and analyze whether incentives can be offered by the City to encourage the achievement of this credit by LEED certified projects.

## WEc3 Potable Water Use Reduction

### Credit Requirements

Potable water is typically used to irrigate the landscape and for all plumbing fixtures within a building. Installing water efficient fixtures can significantly reduce potable water consumption. Benefits for the City are reduced depletion of natural resources. To achieve WEc3.1, a project must employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation) after meeting the Energy Policy Act of 1992 fixture performance requirements. To achieve WEc3.2, a project must use 30% less water than this standard.

### Key Findings

*Cumulative annual water savings achieved by these projects is equivalent to the water use consumption of 32 average households*

- ❑ 60% of LEED certified projects achieved the credit
- ❑ Annual potable water savings from projects implementing this strategy is 3.2 million gallons.

### Achievement Level

60% of LEED certified projects in Seattle achieved this credit and the estimated average annual potable water use reduction achieved by these projects is 35%, higher than the 30% requirement for WEc3.2. The annual potable water savings associated with these projects is 3.2 million gallons.

### Key Strategies

The key strategies implemented by the projects to accomplish these credits are:

- ❑ Low-flow water efficient fixtures
- ❑ Waterless urinals
- ❑ Stormwater Reuse

The percentage of projects that achieved the credit and incorporated the particular key strategies is shown in Figure 5. The chart also indicates the total annual water savings in gallons achieved by all the projects for each strategy.

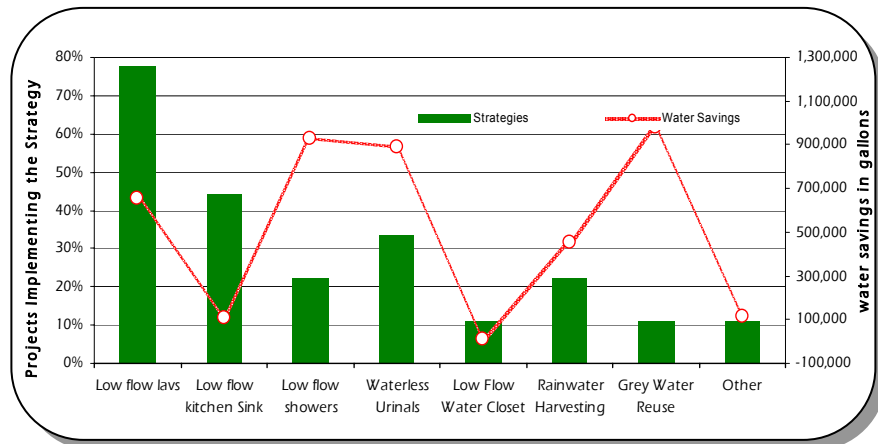


Figure 6 Key Strategies Implemented to achieve WEc3 by LEED Certified projects in Seattle and corresponding Annual Water Savings in gallons for each strategy.

Based on the LEED calculation methodology for water savings Figure 7 indicates that the top three strategies accounting for maximum water savings by LEED Certified projects in Seattle are Greywater Reuse (23.7%), Low flow showers (22.5%) and Waterless Urinals (21.6%). These are followed by Low flow lavatories (15.9%) and Rainwater reuse (10.9%).

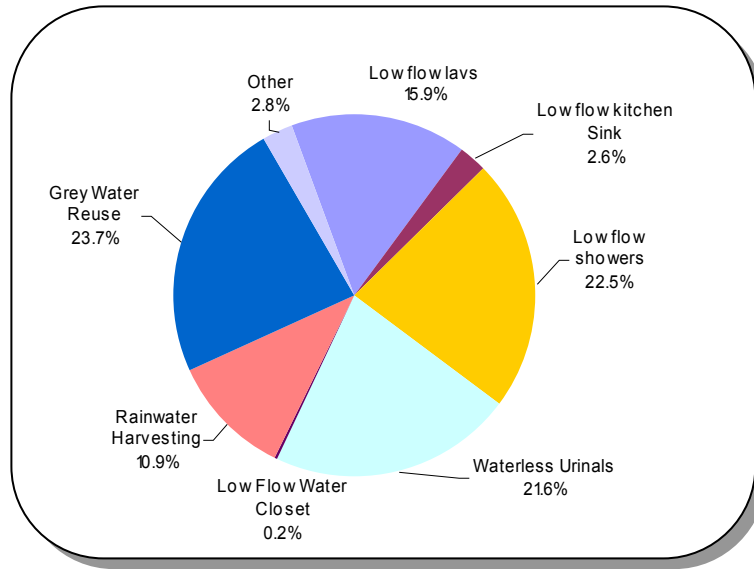


Figure 7 Total Annual Water Savings achieved by LEED Certified projects in Seattle

### Projected Future Benefits

Future projects in Seattle can save up to 24 million gallons of water in the next 20 years by successful implementation of this strategy.

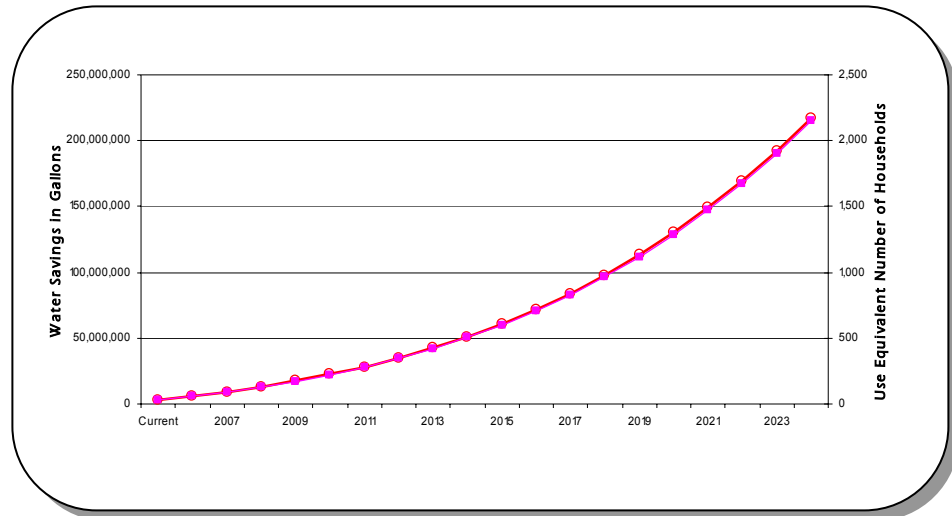


Figure 8 Projected Cumulative Water Savings for LEED Certified Commercial Buildings in Seattle

## MRc1 Building Reuse

### Key Findings

*One Project out of the 11 LEED NC Certified projects in Seattle achieved this credit.*

- ❑ *13% of LEED certified projects achieved the credit (one LEED NC project and one LEED Existing Building Pilot Project)*
- ❑ *The LEED NC project achieved MRc1.1 and 1.2 for reuse of 100% of shell and structure.*

### Credit Implications

This credit requires projects to use existing shell, structure and non-shell elements. The intent of this credit is to minimize and reduce the environmental impacts of new buildings as they relate to materials manufacture and transport. To achieve credit MRc1.1, a project must reuse at least 75% of the existing walls, floors and roof; to achieve MRc1.2, a project must reuse 100%; to achieve MRc1.3, a project must reuse 100% of the existing shell/structure and 50% of the non-shell/non-structural elements.

### Achievement Level

13% of the LEED Certified projects (2 out of 15) in Seattle have achieved this credit. The projects are certified according to the LEED for New Construction and LEED for Existing Buildings (Pilot) rating systems. The LEED NC certified project reused 99% of the existing building shell and structure thus achieving both MRc1.1 and 1.2. The LEED EB Pilot project reused 100% of the existing shell and structure. However, the LEED EB Pilot rating system differed from the NC system in that it only awarded 1 credit for 100% continuing use of an existing building. (The final LEED-EB Version 2 rating system eliminated this credit altogether for existing buildings since all of them will, in one form or another, reuse the existing building.)

### Key Strategies

No strategies are identified with this credit.

### Projected Benefits

A significant number of projects did not achieve this credit and with limited data it is difficult to extrapolate the benefits of achieving this credit for future commercial construction in Seattle.

## MRc2 Construction Waste Management

### Key Findings

93% of the LEED certified projects in Seattle achieved this credit.

- ❑ These projects diverted an average of 21.2 lbs/sq.ft. of construction waste out of a total of 24.4 lbs/sq.ft. of materials (representing an average diversion rate of >80%)
- ❑ These projects diverted a total of 22,012 tons of construction waste from the

### Credit Implications

Construction and demolition activities generate enormous quantities of solid waste that chokes our landfills, reduces demand for virgin resources and, in turn, reduces the environmental impacts associated with resource extraction, processing and transportation. The majority of this waste can potentially be recycled, and recycling opportunities are expanding rapidly in many communities. To achieve credit MRc2.1, a project must divert at least 50% of construction waste from the landfill; to achieve MRc2.2, a project must divert at least 75%.

### Achievement Level

93% of the LEED Certified projects (14 out of 15) in Seattle have achieved this credit. The projects are certified according to the LEED for New Construction (11 projects), LEED for Commercial Interiors (2 projects) and LEED for Core and Shell (1 project) rating systems. All except one of the projects diverted over 75% of construction waste, thus achieving both MRc2.1 and 2.2. The one project that did not achieve MRc2.2 was a residential high rise project in the NC rating system.

The average rate of construction waste diversion was 21 lbs/sq.ft. out of a total of 24 lbs/sq.ft. of construction waste generated, representing an average diversion rate of 81%. In all, the construction waste diverted from the landfill for these 14 projects totals to 22,012 tons.

### Key Strategies

The pie chart below and the bar chart on the next page show the typical waste products (by weight) recycled by the projects that achieved this credit. Concrete, wood, steel and gypsum represent the majority of waste recycled (Figure 10). The comingled percentage is also high, but the LEED documentation does not give a breakdown on the materials represented by it.

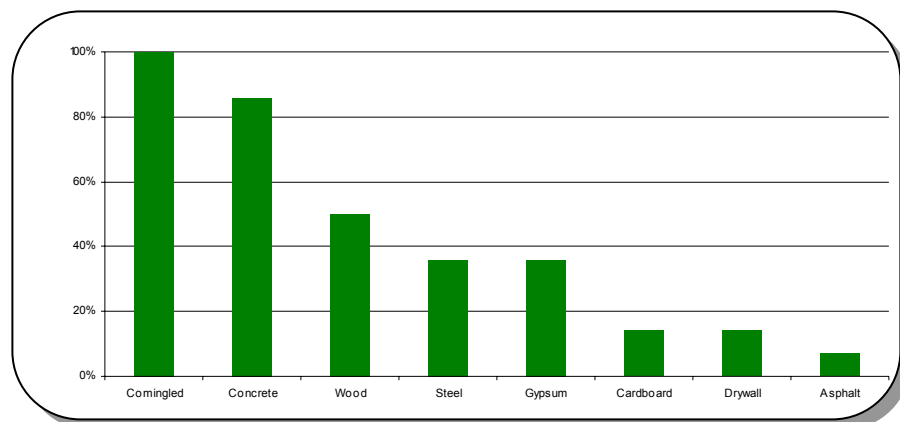


Figure 9 Key Strategies Implemented to achieve MRc2 by LEED Certified Projects in Seattle

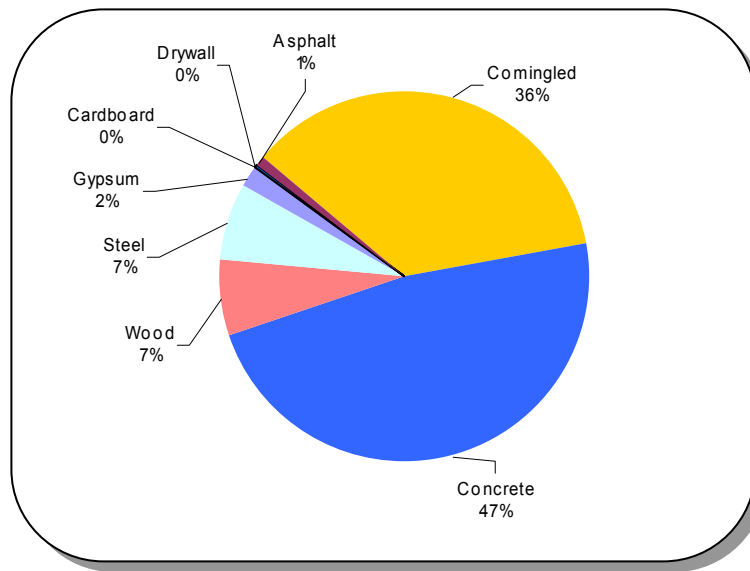


Figure 10 Construction Waste Diverted

### Projected Benefits

The standard practice in Seattle results in a Construction Waste Diversion rate of 66% <sup>1</sup>. Based on the diversion rate achieved by LEED certified projects Figure 11 indicates the projected construction waste diversion because of standard practice and LEED.

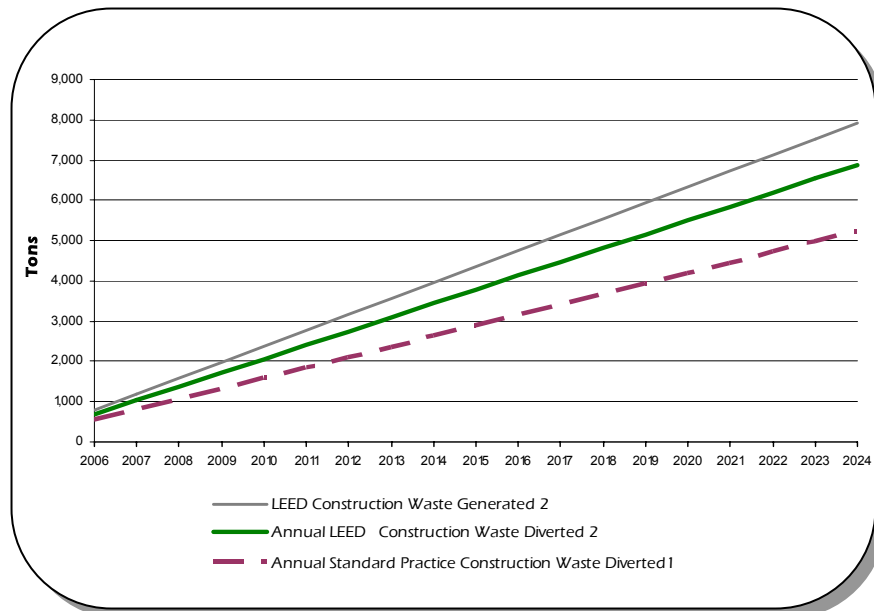


Figure 11 Projected Annual Construction Waste for LEED Certified Commercial Construction in Seattle

<sup>1</sup> Based on 'King County C&D Waste Characterization and Recycling Industry Profile', Cascadia Consulting Group, Final Report 2002  
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The construction waste diversion trends for LEED projects in Seattle indicate that LEED projects will divert an extra 17,000 tons of waste as compared to the standard practice.

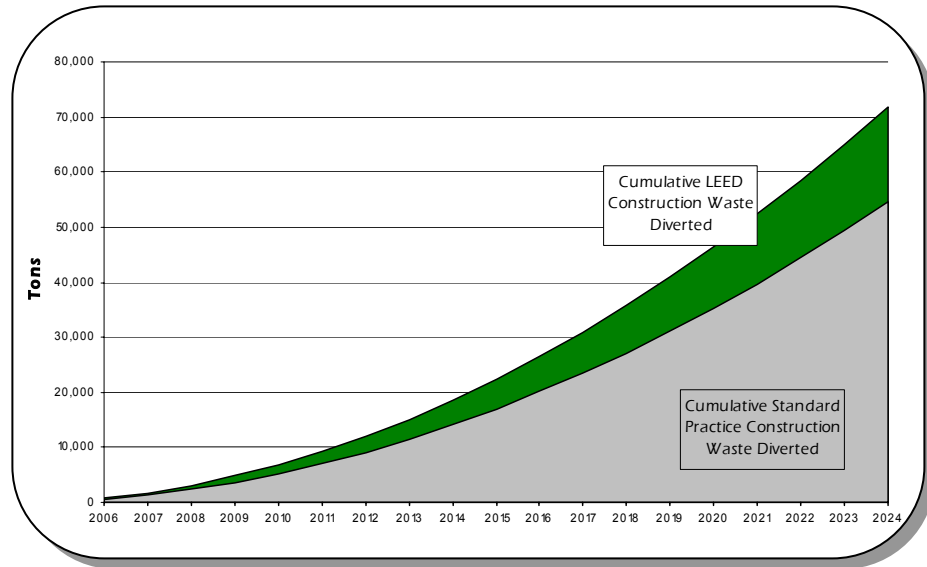


Figure 12 Projected Cumulative Construction Waste Diverted

## MRc3 Resource Reuse

### Key Findings

*Two projects out of the 15 LEED certified projects in Seattle achieved this credit.*

- ❑ *13% of LEED certified projects achieved the credit (one LEED NC project and one LEED CI Project)*
- ❑ *The total material value of salvaged products used on these projects is \$563,833.*

### Credit Implications

This credit requires projects to reuse building materials and products in order to reduce demand for virgin materials and to reduce waste, thereby reducing impacts associated with extraction, processing and transportation of virgin resources. To achieve credit MRc3.1, a project must use at least 5% (by cost) of salvaged, refurbished or reused materials, products and furnishings. To achieve MRc3.2, a project must use at least 10%.

### Achievement Level

13% of the LEED Certified projects (2 out of 15) in Seattle have achieved this credit. The projects are certified according to the LEED for New Construction and LEED for Commercial Interiors rating systems. The LEED NC certified project used 13.8% of salvaged materials; the LEED CI project reused 20.3%, for an average use of over 17%. Thus both projects achieved MRc3.1 and 3.2, for a total of 2 points on this credit. The LEED CI project achieving 20.3% is also eligible for an Innovation Credit for Exemplary Performance on this credit. The total material value of salvaged products used on these projects is \$563,833.

### Key Strategies

The key salvaged materials used in the projects to accomplish these credits are:

- ❑ Furniture
- ❑ Purlins & Columns
- ❑ Doors & Frames
- ❑ Tiles
- ❑ Blinds
- ❑ Rubble

### Projected Benefits

A significant number of projects did not achieve this credit and with limited data it is difficult to extrapolate the benefits of achieving this credit for future commercial construction in Seattle.



## MRc4 Recycled Content

### Key Findings

*80% of the 15 LEED certified projects in Seattle achieved this credit.*

- ❑ *Recycled content percentages for these LEED projects averaged 15.1%.*
- ❑ *The total material value of recycled products used on these projects is \$18,538,305.*
- ❑ *Metals represent the dominant source (78.5%) of recycled materials for the projects that achieved this credit.*

### Credit Implications

This credit requires projects to use recycled content material (either post-consumer or post-industrial). To achieve MRc4.1, a project must use at least 5% (by cost, calculated as post-consumer + ½ post-industrial content). To achieve MRc4.2, a project must use at least 10%.

### Achievement Level

80% of the LEED Certified projects (12 out of 15) in Seattle have achieved this credit. The average recycled content percent by cost is 15.1%, ranging from a low of 5.6% to a high of 34.3% (for the Seattle Public Library Project). The total material value of recycled products used on all projects was \$18,538,305 (post consumer + ½ post-industrial materials value).

### Key Strategies

Metals are clearly the dominant recycled material used in the Seattle projects, representing 78.5% of all the recycled materials. The following list and pie chart show the project averages of metal and other recycled materials used:

- ❑ Metal (78.5%)
- ❑ Concrete (11%)
- ❑ Casework (0.6%)
- ❑ Insulation (0.5%)
- ❑ Gypsum (0.5%)
- ❑ Carpet (0.4%)
- ❑ Glass (0.3%)
- ❑ Ceiling Panels (0.3%)
- ❑ Toilet Partitions (0.2%)
- ❑ Flooring (0.2%)
- ❑ Others (7.1%)

### Projected Benefits

Future new construction LEED projects would be expected to incorporate similar rates of recycled materials. Thus if 80% of future new construction projects achieve the credit with an average of 15.1% recycled content by cost, recycled materials should represent 12% of all future new construction costs.

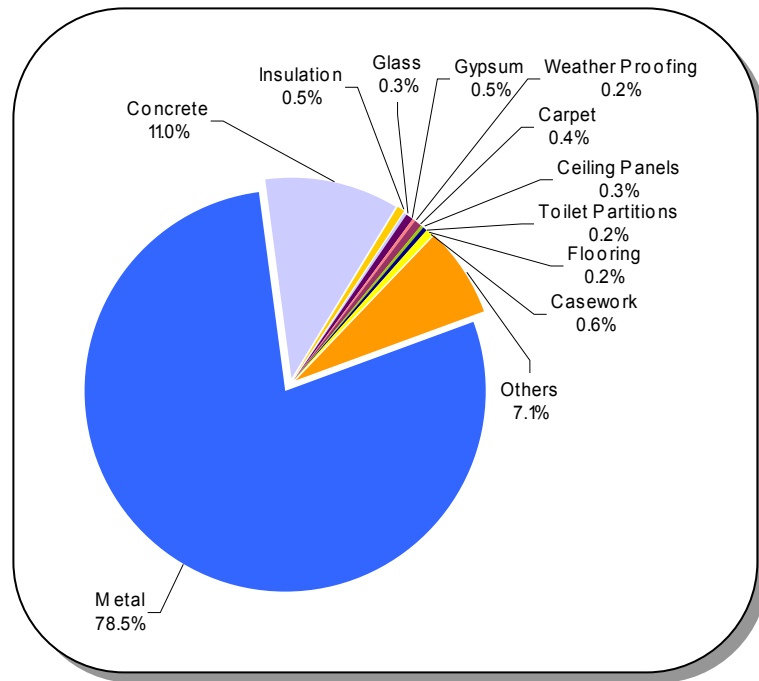


Figure 13 Total Recycled Content Material Cost of LEED Projects in Seattle for MRc4 credit achievement

## EAc1 Optimize Energy Performance

### Key Findings

- ❑ 73% of LEED certified projects in Seattle achieved the credit (11 of 15).
- ❑ 53% of LEED certified projects achieved this credit by square foot of LEED certified NC and CS projects.
- ❑ LEED NC and CS Certified projects saved 6.9 million KWh of electricity and 73,000 Therm of gas annually, relative to ASHRAE Standard 90.1-1999 baseline.
- ❑ The largest energy end use savings for projects in Seattle is Space Cooling (43%) followed by Lighting (21%) and Space heating (18%).
- ❑ The local energy code is more stringent than ASHRAE Standard 90.1-1999 and it is likely that some of the savings projected can be attributed to that.

### Credit Requirements

This credit requires projects to reduce the design energy cost for regulated loads compared to the ASHRAE/IESNA Standard 90.1-1999 baseline using the Energy Cost Budget Method described in Section 11 of the ASHRAE standard. The projects are required to demonstrate the energy cost savings by using a whole building energy simulation tool. Projects may achieve up to 10 LEED points depending on the % of energy cost savings they achieve.

### Achievement Level

73% of the LEED Certified projects (11 out of 15) in Seattle have achieved this credit. If LEED NC and CS project credit achievement is normalized by square footage of buildings, then 53% of LEED certified project area achieved this credit. Relative to ASHRAE Standard 90.1-1999 baseline, these projects on average save 6.9 million kWh of electricity and 73,000 therms of gas per year. The average total Energy Use Intensity (EUI) savings for these projects is as follows:

- ❑ Total EUI: 30.6 MBtu/sq.ft/Yr
- ❑ Electricity EUI: 23.3 MBtu/sq.ft/Yr
- ❑ Gas EUI: 7.3 MBtu/sq.ft/Yr

### Key Strategies

LEED documentation for these projects indicate that the total largest energy end use savings are achieved for Space Cooling (43%) followed by Lighting (21%) and Space Heating (18%).

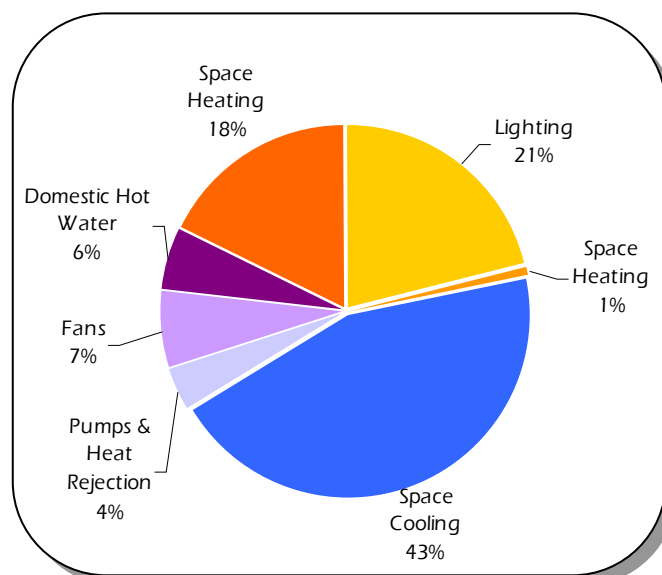


Figure 8 Total Annual Energy Savings for LEED Certified Projects in Seattle by Enduse

### Projected Benefits

Based on the whole building energy simulation results for the 7 LEED NC and CS projects the energy savings have been projected for future commercial construction in Seattle. The projected benefits assume that that 53% of the certified commercial construction square footage will achieve the credit and will on average save 23 MBtu/SF/Yr of Electricity and 7 MBtu/SF/Yr of gas relative to ASHRAE Standard 90.1-1999.

Figure 9 and 10 demonstrate the projected annual and cumulative energy savings that will be achieved by future LEED certified commercial construction in Seattle.

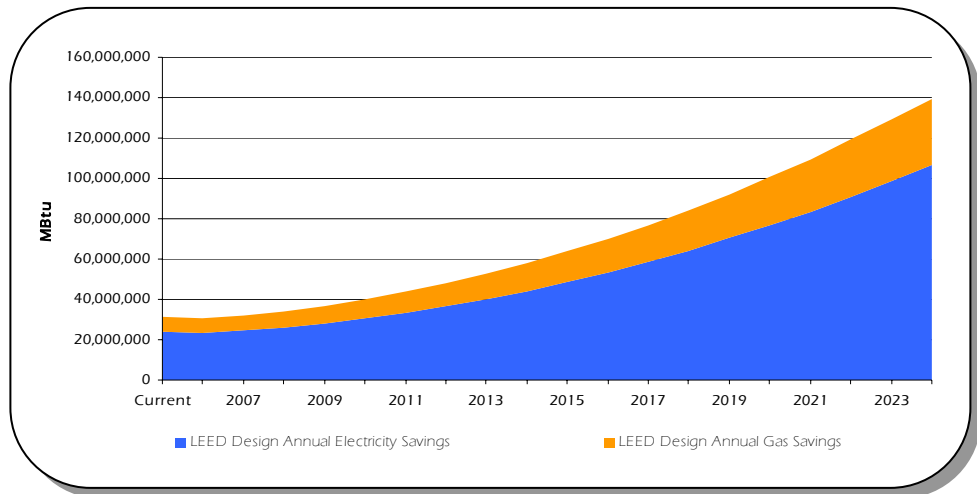


Figure 9 Projected Total Annual Energy Savings for Future LEED Certified New Commercial Construction in Seattle

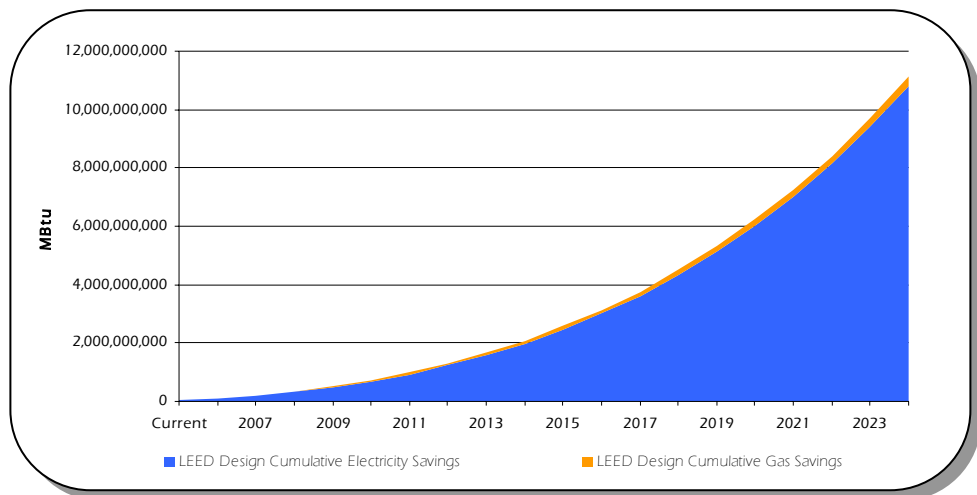
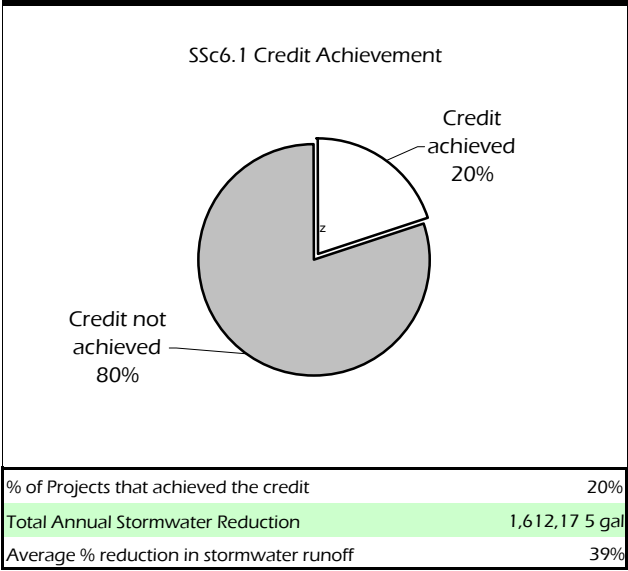


Figure 10 Projected Cumulative Energy Savings for Future LEED Certified New Commercial Construction in Seattle

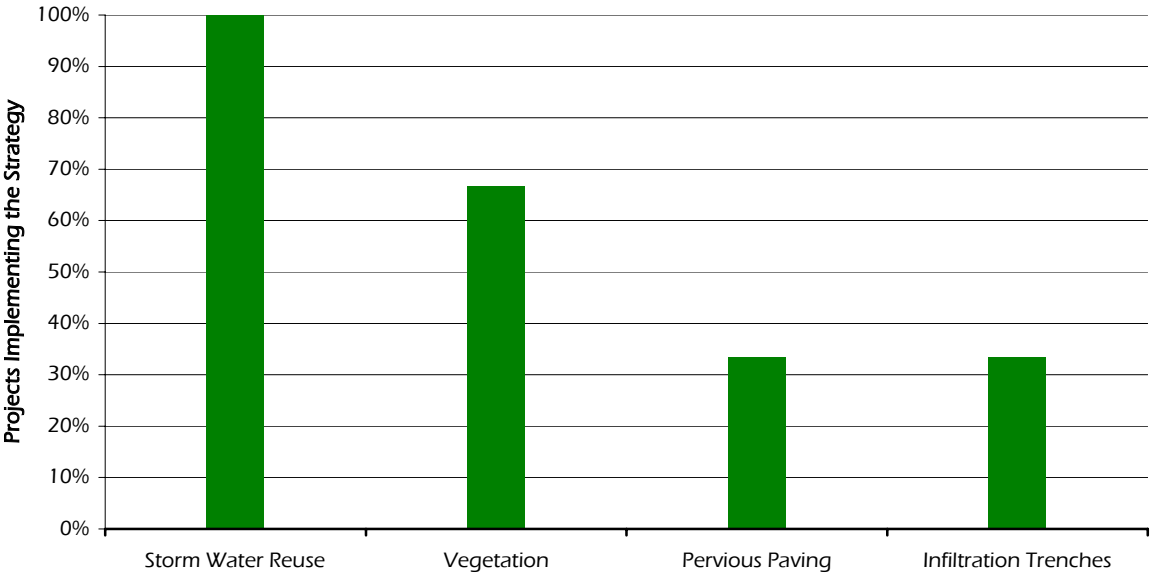
SSc6.1 Stormwater Management, Rate & Quantity

			Pre-development		Post-development		Strategies						
Project		Site Area	LEED Design Impervious Area %	Total Impervious Area	Total Pervious Areas	Total Impervious Area	Total Pervious Areas	Runoff Quantity Reduction	Annual Run off Reduction	Storm Water Reuse	Vegetation	Pervious Paving	Infiltration Trenches
		sqft		sqft	sqft	sqft	sqft	%	Gallons	Y/N	Y/N	Y/N	Y/N
	1 Public Health Sciences Building												
	2 Traugott Terrace												
	3 Seattle Pacific University Science Building												
	4 Seattle Central Library												
	5 Park 90/5 C												
Y	6 High Point Community Center Addition	43,725	87%	28,281	15,444	37,888	5,838	25.0%	165,975	Y	Y	N	Y
	7 Fisher Pavilion												
	8 City of Seattle Justice Center												
Y	9 Carkeek Park Environmental Learning Center	13,068	21%	1,152	11916	2800	10268	45.4%	46,200	Y	Y	Y	N
	10 Zimmer Gunsul Frasca Office												
	11 SBRI Building - Core & Shell												
	12 Park 90/5 A												
Y	13 King Street Center	66,179	100%	66,179	0	66,179	0	47.0%	1,400,000	Y	N	N	N
	14 Nordheim Court Student Housing												
	15 Merrill Hall												
Total									1,612,175	3	2	1	1
Y	Credit achieved	3	Average					39.1%					
N	Credit not achieved	12	% of Projects that implemented the strategy							100%	67%	33%	33%

Key Findings



Strategies



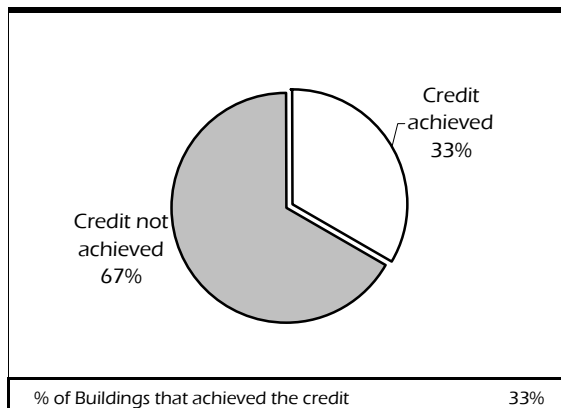
## SSc6.2 Stormwater Management, Treatment

		Strategies		
Project		Infiltration Vault/trench	Wet Vault	Bioswales
		Y/N	Y/N	Y/N
Y	1 Public Health Sciences Building	na*	na	na
	2 Traugott Terrace			
	3 Seattle Pacific University Science Building			
	4 Seattle Central Library			
	5 Park 90/5 C			
Y	6 High Point Community Center Addition	Y	N	N
	7 Fisher Pavilion			
Y	8 City of Seattle Justice Center	N	Y	N
Y	9 Carkeek Park Environmental Learning Center	Y	N	N
	10 Zimmer Gunsul Frasca Office			
	11 SBRI Building - Core & Shell			
	12 Park 90/5 A			
	13 King Street Center			
	14 Nordheim Court Student Housing			
Y	15 Merrill Hall	Y	N	Y
Totals		3	1	1
% of Projects that implemented the strategy		75%	25%	25%

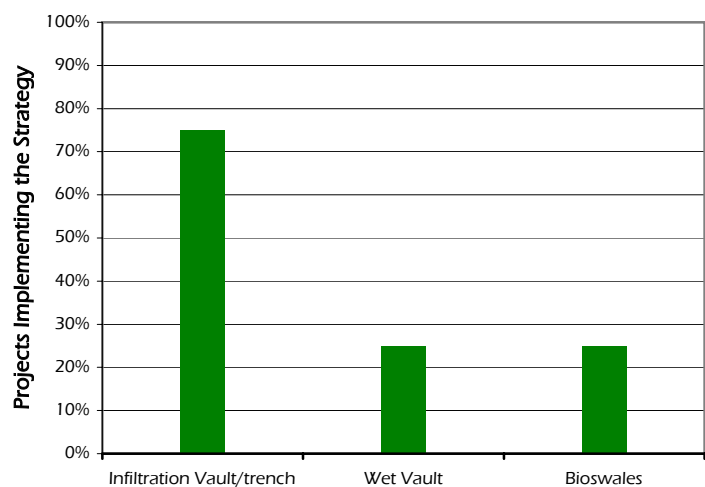
\* Not Available

Y	Credit achieved	5
N	Credit not achieved	10

### Key Findings



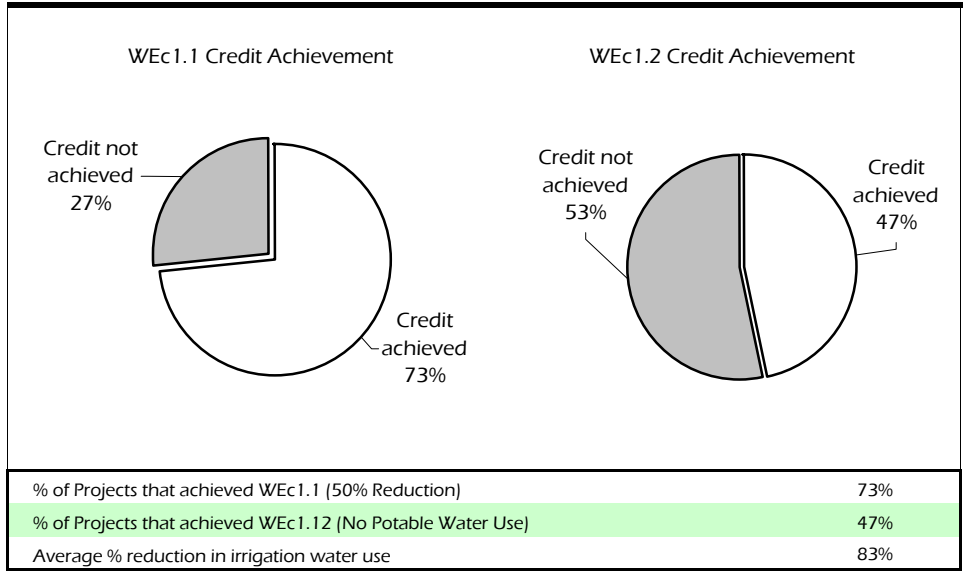
### Strategies



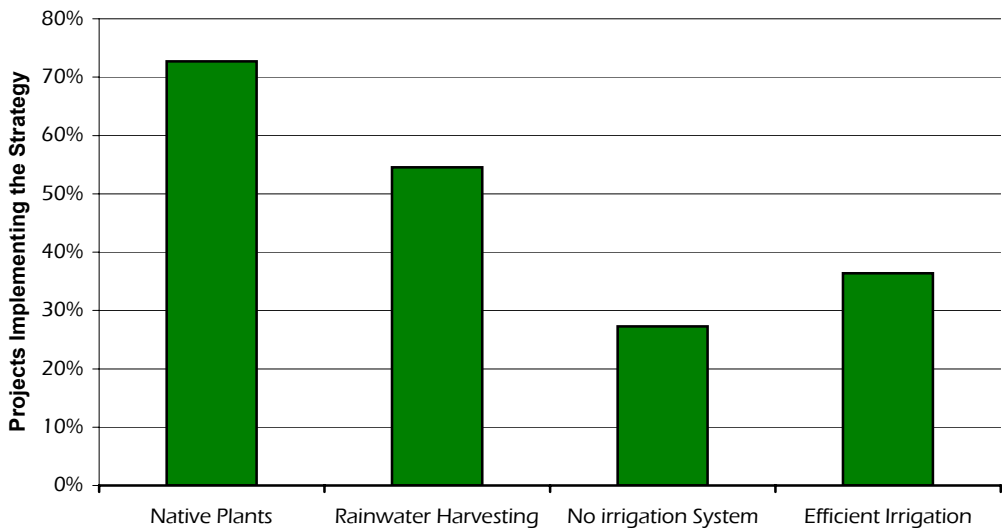
WEc1 Water Efficient Landscaping

						Strategies				
Project		Site Area	Landscape Area	LEED Design Irrigation Water Use (July)	Irrigation water savings relative to baseline (July)	% Irrigation Water Use Reduction	Native Plants	Rainwater Harvesting	No irrigation System	Efficient Irrigation
		sqft	sqft	gals	gals	%	Y/N	Y/N	Y/N	Y/N
Y	1 Public Health Sciences Building	113,218	23,740	87,367	87,367	100%	N	Y	N	N
	2 Traugott Terrace									
Y	3 Seattle Pacific University Science Building	359,806	23,200	74,299	82,229	53%	N	N	N	Y
Y	4 Seattle Central Library	57,600		22,565	34,109	100%	N	Y	N	N
Y	5 Park 90/5 C	206,474	33,977	72,000	72,000	100%	Y	Y	N	N
Y	6 High Point Community Center Addition	43725	6,698			100%	Y	N	Y	N
Y	7 Fisher Pavilion	113,256				50%	Y	N	N	Y
Y	8 City of Seattle Justice Center	32,659	1,125	2,805	2,805	100%	Y	Y	N	Y
Y	9 Carkeek Park Environmental Learning Center	13068	8306	3,005	3,005	50%	Y	Y	N	N
	10 Zimmer Gunsul Frasca Office									
Y	11 SBRI Building - Core & Shell					100%	Y	N	Y	N
	12 Park 90/5 A									
Y	13 King Street Center	66,179				100%	Y	N	Y	N
	14 Nordheim Court Student Housing									
Y	15 Merrill Hall			2180	3654	63%	Y	Y	N	Y
		WE c 1.1	WE c 1.2	Total			8	6	3	4
Y	Credit achieved	11	7	Average		83%				
N	Credit not achieved	4	8	% of Projects that implemented the strategy			73%	55%	27%	36%

Key Findings



Strategies

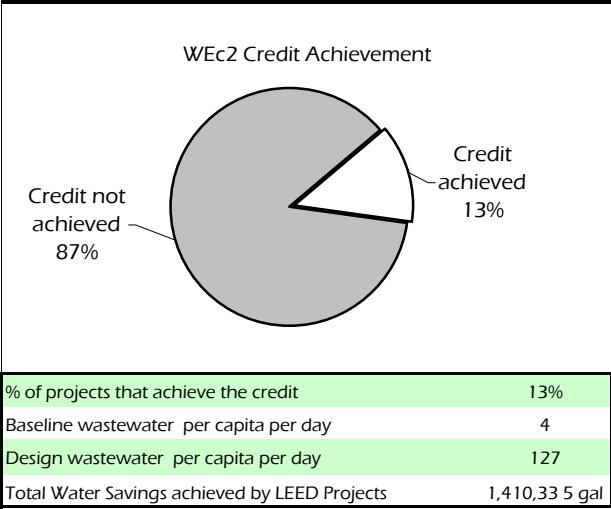


WEc2 Innovative Wastewater Technologies

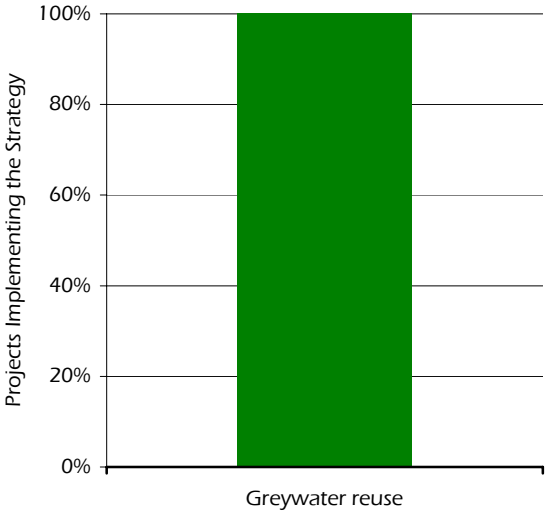
Project		FTE	Baseline Wastewater Generated	Baseline wastewater	LEED Design Wastewater Generated	LEED Design wastewater	Annual Wastewater Reduction	% Savings	Greywater reuse
		#	gals/Year	gal/capita/day	gals/Year	gal/capita/day	gals/Year	%	Y/N
	1 Public Health Sciences Building	316	448,001	4	17,666	12	430,335	96%	Y
	2 Traugott Terrace								
	3 Seattle Pacific University Science Building								
	4 Seattle Central Library								
Y	5 Park 90/5 C								
	6 High Point Community Center Addition	1,045	1,273,740	3	293,740	241	980,000	77%	Y
	7 Fisher Pavilion								
	8 City of Seattle Justice Center								
	9 Carkeek Park Environmental Learning Center								
	10 Zimmer Gunsul Frasca Office								
	11 SBRI Building - Core & Shell								
	12 Park 90/5 A								
Y	13 King Street Center								
	14 Nordheim Court Student Housing	1,045	1,273,740	3	293,740	241	980,000	77%	Y
	15 Merrill Hall								
Total							1,410,335		2
Average				4		127			
% of Projects that implemented the strategy									100%

Y	Credit achieved	2
N	Credit not achieved	13

Key Findings



Strategies

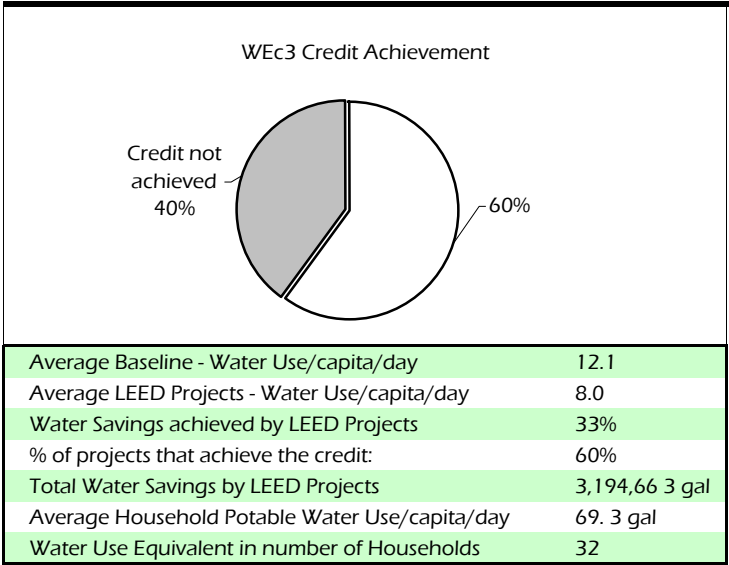




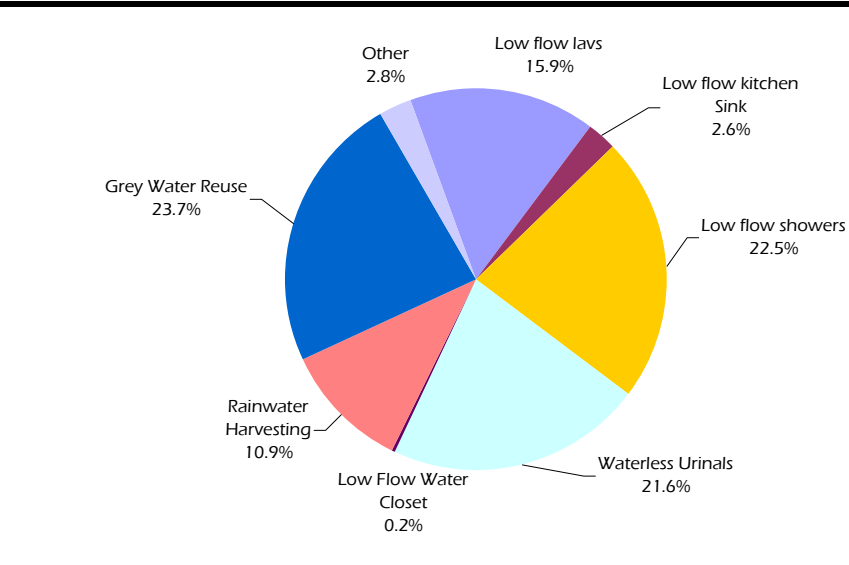
WEc3 Potable Water Use Reduction

											Strategies									
Project		FTE	Male	Female	Annual Work Days	EPACT (Baseline) Water Use	LEED Design Water Use	Water Savings	% Savings	EPACT Baseline Water Use	LEED Design Water Use	Low flow lavs	Low flow kitchen Sink	Low flow showers	Waterless Urinals	Low Flow Water Closet	Rainwater Harvesting	Grey Water Reuse	Other	
		#	#	#	#	gals/Yr	gals/Yr	gals / yr	%	gals/capita/day	gals/capita/day	gals	gals	gals	gals	gals	gals	gals	gals	
	1 Public Health Sciences Building											0	0	0	0	0	0	0	0	
Y	2 Traugott Terrace	53	27	26	365	618,228	380,157	238,071	39%	32	20	19,073	13,688	91,250	0	0	0	0	113,880	
	3 Seattle Pacific University Science Building											0	0	0	0	0	0	0	0	
Y	4 Seattle Central Library	2000	1000	1000	354	4,568,149	3,417,649	1,150,500	25%	6	5	442,500	0	0	708,000	0	0	0	0	
Y	5 Park 90/5 C	316	212	104	365	1,043,864	533,714	510,150	49%	9	5	64,704	0	0	0	0	445,446	0	0	
	6 High Point Community Center Addition											0	0	0	0	0	0	0	0	
	7 Fisher Pavilion											0	0	0	0	0	0	0	0	
	8 City of Seattle Justice Center											0	0	0	0	0	0	0	0	
Y	9 Carkeek Park Environmental Learning Center	6	3	3	260	15,340	10,220	5,120	33%	10	7	0	0	0	0	0	5,120	0	0	
Y	10 Zimmer Gunsul Frasca Office	90	50	40	260	155,220	116,025	39,195	25%	7	5	35,100	4,095	0	0	0	0	0	0	
Y	11 SBRI Building - Core & Shell	474	237	237	365	1,052,117	814,228	237,889	23%	6	5	64,879	0	0	173,010	0	0	0	0	
	12 Park 90/5 A											0	0	0	0	0	0	0	0	
Y	13 King Street Center	1045	360	685	230	2,343,615	2,343,615	0	0%	10	10	0	0	0	0	0	0	980,000	0	
Y	14 Nordheim Court Student Housing	460	230	230	365	3,301,060	2,317,385	983,675	30%	20	14	25,185	83,950	839,500	0	0	0	0	0	
Y	15 Merrill Hall	43	22	21	260	81,738	51,675	30,063	37%	7	5	5,870	4,017	0	11,440	8,736	0	0	0	
Total		4487	2141	2346		13,179,331	9,984,668	3,194,663				657,310	105,750	930,750	892,450	8,736	450,566	980,000	113,880	
Average									33%	12.1	8.0									
Total for LEED NC & CS Projects		2878	1494	1384		9,628,379	6,710,800	2,917,579												
Average for LEED NC & CS Projects									35%	14	9									
% of Projects that implemented the strategy												78%	44%	22%	33%	11%	22%	11%	11%	
Y	Credit achieved	9	Number of Projects that implemented the strategy										7	4	2	3	1	2	1	1
N	Credit not achieved	6	% of Total Water Savings										21%	3%	29%	28%	0.3%	14%	31%	4%

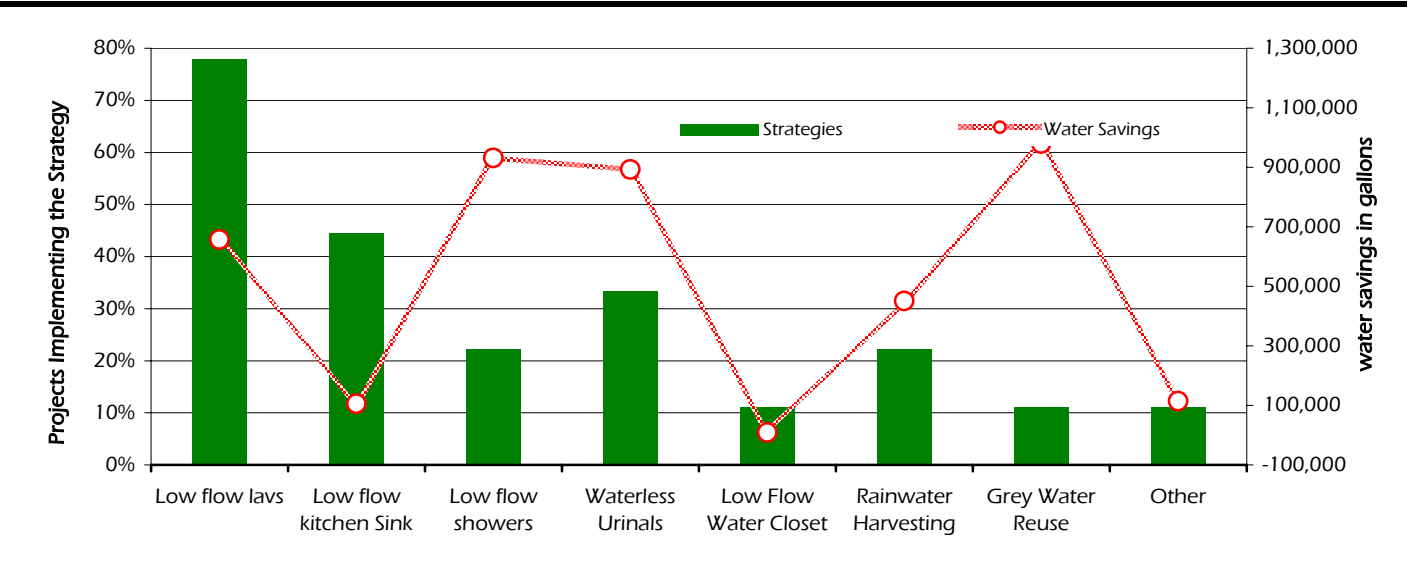
Key Findings



Water Saving Strategies



Strategies vs. Water Savings



WEc3 Potable Water Savings Projections

Assumptions

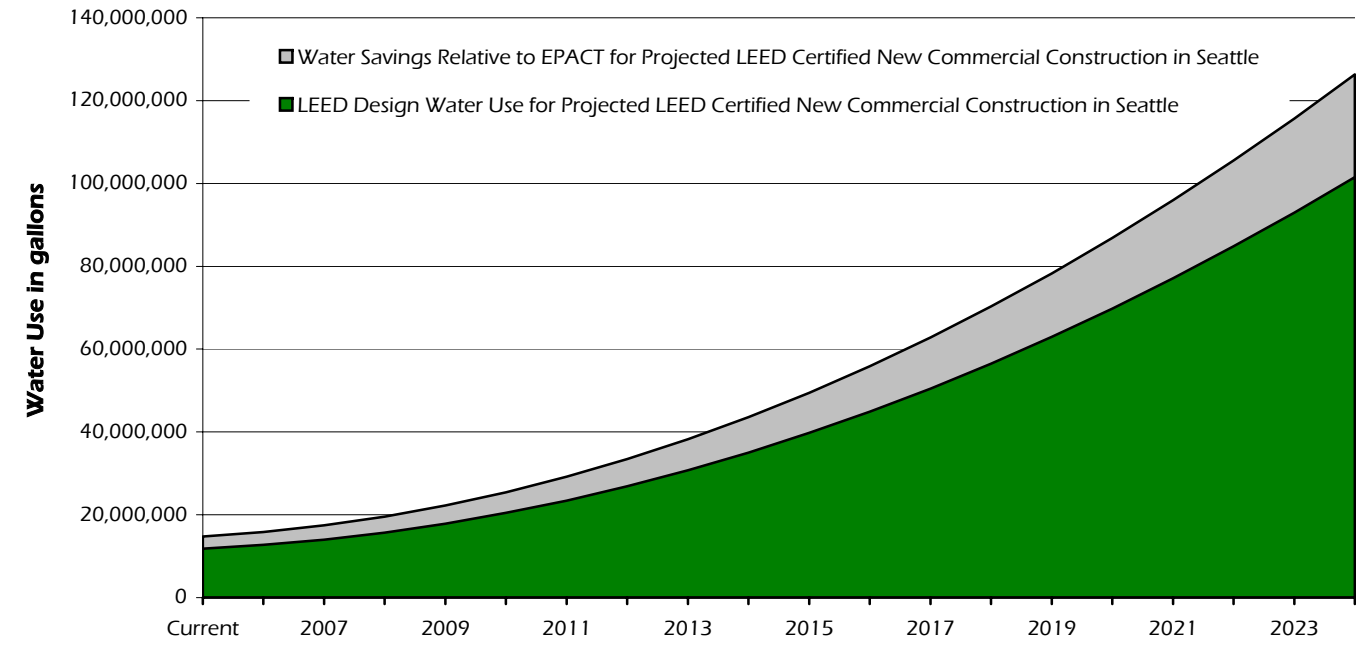
Based on Compliance Plan 2004 and LEED WEc3 Analysis for Seattle Projects	
Projected Annual New Commercial Construction in Seattle	1,298,10 6 SF
FTE Occupancy Associated with New Commercial Construction	4,167
Average Baseline Water Use in gallons per capita per day for LEED NC	1 4 gal
Average LEED NC Project Water Use in gallons per capita per day	9 gal
% of LEED Certified Projects that achieved WE c3 (by building SF)	55%
Average Household Potable Water Use/capita/day	6 9 gal

Projected Water Use for Future LEED Certified Projects in Seattle

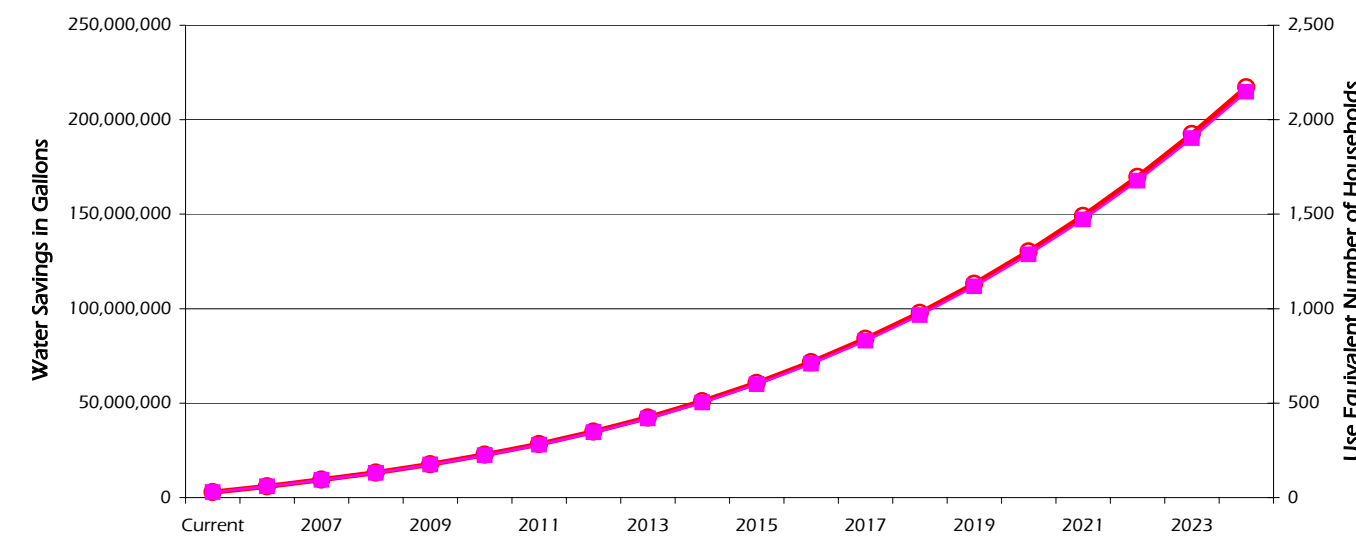
	SF of LEED Commercial Construction	% Commercial New Construction Adopting LEED	FTE for LEED Projects	LEED Design Annual Water Use <sup>1</sup>	Baseline Annual Water Use	Annual Water Savings	Cumulative Water Savings	Use Equivalent Number of Households
	Sq.ft.		#	Gallons	Gallons	Gallons	Gallons	#
Current	1,822,992	na	2,878	11,857,588	14,753,120	2,895,532	2,895,532	29
2006	1,887,897	5%	3,086	12,714,564	15,819,363	3,104,799	6,000,331	59
2007	1,985,255	8%	3,399	14,004,149	17,423,855	3,419,706	9,420,037	93
2008	2,115,066	10%	3,816	15,722,222	19,561,468	3,839,246	13,259,283	131
2009	2,277,329	13%	4,337	17,868,783	22,232,203	4,363,420	17,622,703	174
2010	2,472,045	15%	4,962	20,443,832	25,436,060	4,992,227	22,614,930	224
2011	2,699,214	18%	5,691	23,447,370	29,173,038	5,725,668	28,340,598	280
2012	2,958,835	20%	6,524	26,879,396	33,443,139	6,563,743	34,904,341	345
2013	3,250,909	23%	7,462	30,744,030	38,251,487	7,507,457	42,411,798	419
2014	3,575,435	25%	8,504	35,037,153	43,592,957	8,555,804	50,967,602	504
2015	3,932,415	28%	9,650	39,758,763	49,467,549	9,708,785	60,676,387	600
2016	4,321,847	30%	10,900	44,908,862	55,875,262	10,966,400	71,642,787	708
2017	4,743,731	33%	12,254	50,487,449	62,816,097	12,328,648	83,971,435	830
2018	5,198,068	35%	13,712	56,494,524	70,290,054	13,795,530	97,766,965	966
2019	5,684,858	38%	15,275	62,934,208	78,302,259	15,368,051	113,135,017	1,118
2020	6,204,101	40%	16,942	69,802,380	86,847,586	17,045,206	130,180,223	1,287
2021	6,755,796	43%	18,713	77,099,040	95,926,035	18,826,995	149,007,218	1,473
2022	7,339,944	45%	20,588	84,824,188	105,537,605	20,713,417	169,720,635	1,677
2023	7,956,544	48%	22,567	92,977,825	115,682,297	22,704,472	192,425,107	1,902
2024	8,605,597	50%	24,650	101,559,949	126,360,111	24,800,162	217,225,269	2,147

1 Assumes that 55% of LEED Certified Commercial Construction will achieve this credit and will save an average of 5 gals/FTE/day

Projected Annual Water Use for LEED Certified Commercial Buildings in Seattle



Projected Cumulative Water Savings for LEED Certified Commercial Buildings in Seattle

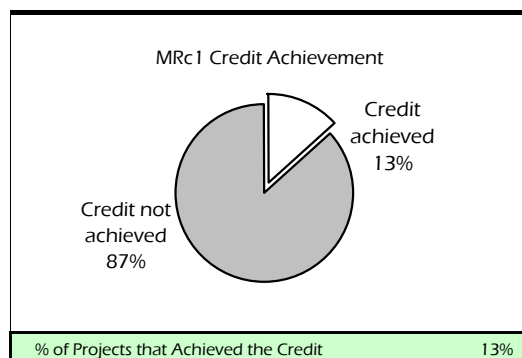


## MRc1 Building Reuse

		Structure			Shell			Non-Shell		
Project		Existing	Reused	% Reused	Existing	Reused	% Reused	Existing	Reused	% Reused
		CF	CF	%	Sqft	Sqft	%	Sqft	Sqft	%
	1 Public Health Sciences Building									
	2 Traugott Terrace									
	3 Seattle Pacific University Science Building									
	4 Seattle Central Library									
Y	5 Park 90/5 C	81613	80706	92.89	174528	173928	99.27	0	0	0
	6 High Point Community Center Addition									
	7 Fisher Pavilion									
	8 City of Seattle Justice Center									
	9 Carkeek Park Environmental Learning Center									
	10 Zimmer Gunsul Frasca Office									
	11 SBRI Building - Core & Shell									
	12 Park 90/5 A									
Y	13 King Street Center			na*			na			na
	14 Nordheim Court Student Housing									
	15 Merrill Hall									
Y	Credit achieved	2								
N	Credit not achieved	13								

\* Analysis is not applicable. The Pilot Version of LEED EB Rating System awarded a point for continued use of an existing building.

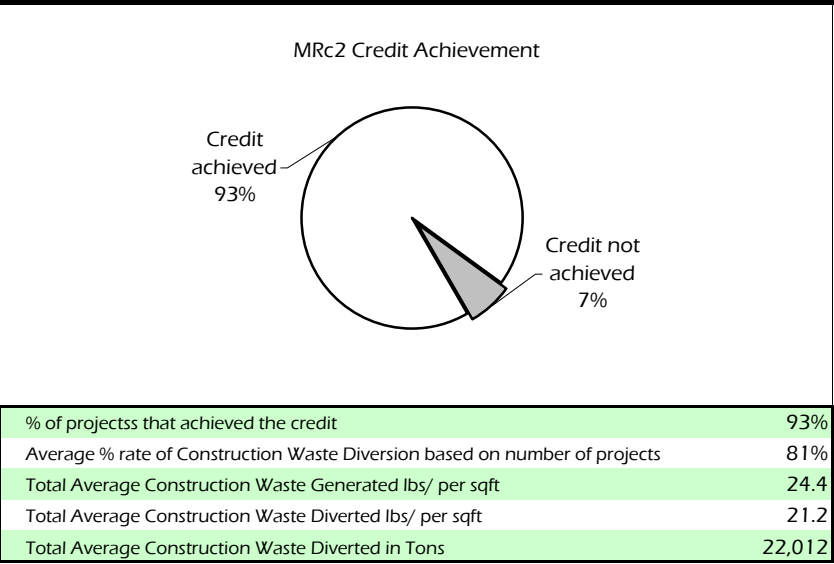
### Key Findings



MRc2 Construction Waste Management

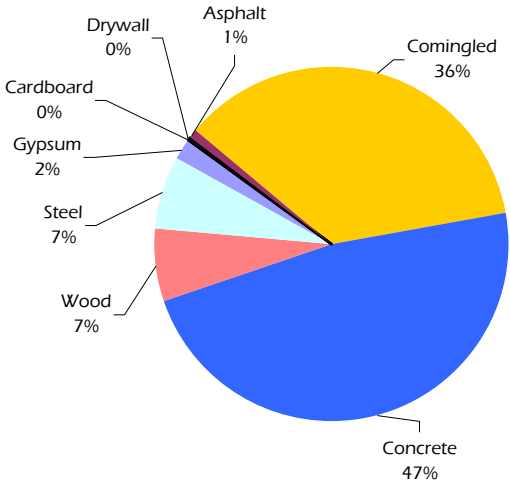
								Waste Stream							
Project		Building Area	Total Construction Waste	Waste Generated per sqft	Waste Diverted	Waste Diverted per sqft	% waste diverted	Comingled	Concrete	Wood	Steel	Gypsum	Cardboard	Drywall	Asphalt
		sqft	tons	lbs/sqft	tons	lbs/sqft	%	tons	tons	tons	tons	tons	tons	tons	tons
Y	1 Public Health Sciences Building	372,000	3364	18.1	2765	14.9	82.2	569	1356	484	143	207	7	0	0
Y	2 Traugott Terrace	38,483	250	13.0	199	10.3	79.0	84	68	27	0	0	0	20	0
Y	3 Seattle Pacific University Science Building	63,000	2440	77.4	2221	70.5	91%	314	1418	444	45.0		0	0	0
Y	4 Seattle Central Library	360,000	5960	33.1	4871	27.1	81.7	1544	1966	161	1192	8	0	0	N
Y	5 Park 90/5 C	172,000	3614	42.0	3469	40.3	96.0	785	2443	0	0	0	0	77	164
Y	6 High Point Community Center Addition	20,000	357	35.7	329	32.9	92.1	112	214	0	3.1	0	0	0	0
Y	7 Fisher Pavilion	79,509	3042	76.5	2618	65.9	86.0	50	2298	189	78	3	0	0	0
Y	8 City of Seattle Justice Center	298,000	4197	28.2	3706	24.9	88.3	3706	0	0	0	0	0	0	0
Y	9 Carkeek Park Environmental Learning Center	17,000	29	3.4	24	2.9	85.1	20	4	0	0	0	0	0	0
Y	10 Zimmer Gunsul Frasca Office	23,000	37	3.2	34	3.0	92.5	8	0	2	0	24	0	0	0
Y	11 SBRI Building - Core & Shell	112,000	571	10.2	484	8.6	84.8	274	210	0	0	0	0	0	0
Y	12 Park 90/5 A	100,000	324	6.5	280	5.6	86.3	166	114	0	0	0	0	0	0
	13 King Street Center														
Y	14 Nordheim Court Student Housing	403,000	773	3.8	628	3.1	86.3	164	160	151	0	150	2	0	0
Y	15 Merrill Hall	18,500	391	42.2	384	41.6	98.4	122	262	0	0	0	0	0	0
	Total	2,076,492	25348		22012			7919	10513	1457	1461	392	9	97	164
	Average			24.4		21.2	81.4								
	% Projects that diverted these materials							100%	86%	50%	36%	36%	14%	14%	7%
Y	Credit achieved	14													
	Credit not achieved	1													

Key Findings

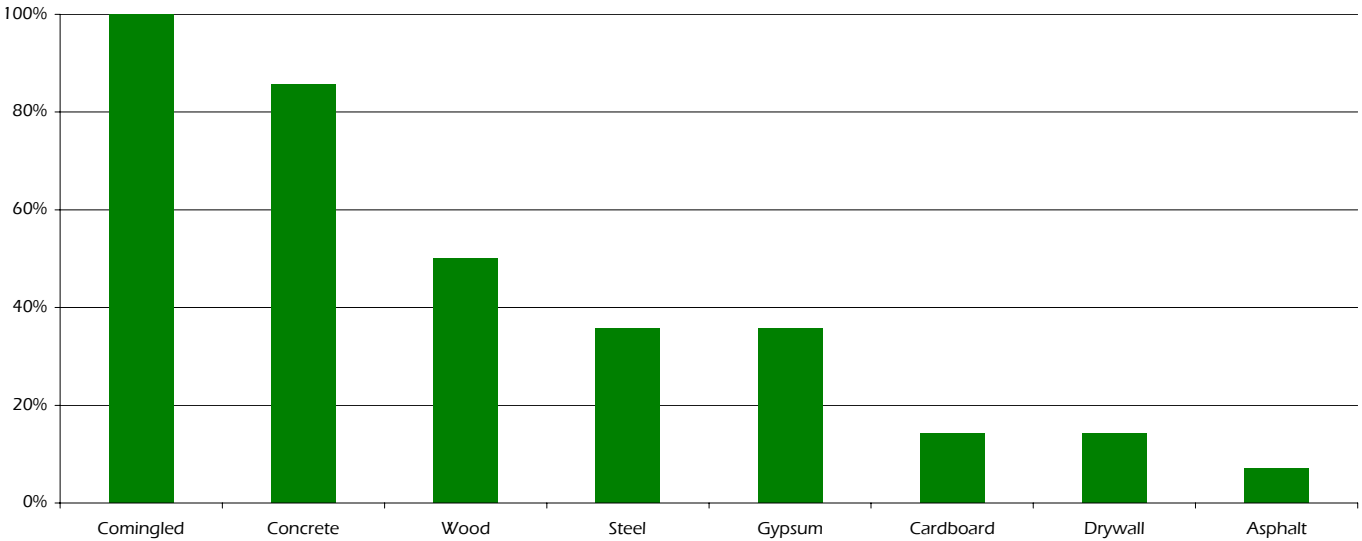


Construction Waste Diverted

% by Weight



% of Projects that Diverted Materials from Landfill



MRc2 Construction Waste Management Projections

Assumptions

Information from Compliance Plan 2004 & LEED MRc2 Analysis for Seattle Projects	
Projected Annual New Commercial Construction in Seattle	1,298,10 6 SF
Standard Practice Construction Waste Recycling Rate in Seattle <sup>1</sup>	66%
Average LEED Construction Waste Generated in lbs/SF	24.4
Average LEED Construction Waste Diverted in lbs/SF	21.2
% of LEED NC Certified Projects that achieved MR c2 (by building SF)	100%

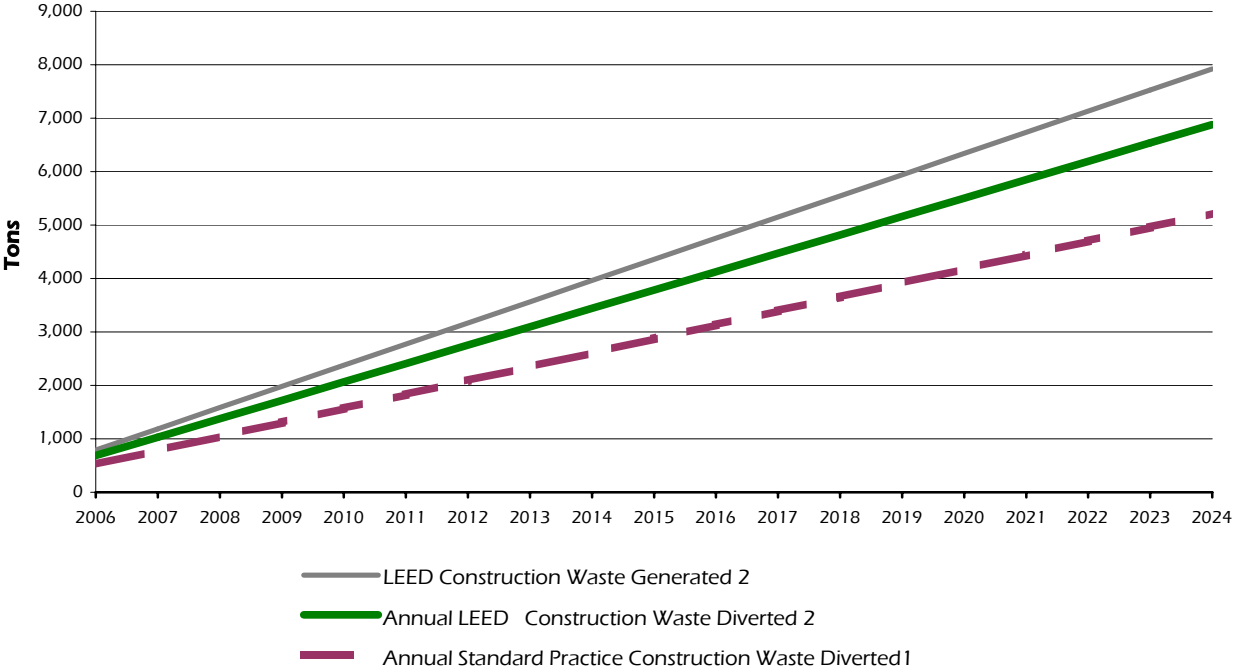
Projected Water Use for Future LEED Certified Projects in Seattle

	Annual SF of LEED Commercial Construction	% Commercial New Construction Adopting LEED	LEED Construction Waste Generated <sup>2</sup>	Annual LEED Construction Waste Diverted <sup>2</sup>	Annual Standard Practice Construction Waste Diverted <sup>1</sup>	Cumulative LEED Construction Waste Diverted	Cumulative Standard Practice Construction Waste Diverted
	Sq.ft.		tons	tons	tons	tons	tons
2006	64,905	5%	792	688	522	688	522
2007	97,358	8%	1,188	1,032	783	1,720	1,305
2008	129,811	10%	1,585	1,376	1,044	3,096	2,350
2009	162,263	13%	1,981	1,720	1,305	4,816	3,655
2010	194,716	15%	2,377	2,064	1,566	6,880	5,221
2011	227,169	18%	2,773	2,408	1,827	9,288	7,049
2012	259,621	20%	3,169	2,752	2,089	12,040	9,137
2013	292,074	23%	3,565	3,096	2,350	15,137	11,487
2014	324,527	25%	3,962	3,440	2,611	18,577	14,097
2015	356,979	28%	4,358	3,784	2,872	22,361	16,969
2016	389,432	30%	4,754	4,128	3,133	26,489	20,102
2017	421,885	33%	5,150	4,472	3,394	30,961	23,496
2018	454,337	35%	5,546	4,816	3,655	35,777	27,151
2019	486,790	38%	5,942	5,160	3,916	40,937	31,067
2020	519,243	40%	6,338	5,504	4,177	46,442	35,244
2021	551,695	43%	6,735	5,848	4,438	52,290	39,682
2022	584,148	45%	7,131	6,192	4,699	58,482	44,381
2023	616,600	48%	7,527	6,536	4,960	65,018	49,341
2024	649,053	50%	7,923	6,880	5,221	71,899	54,562

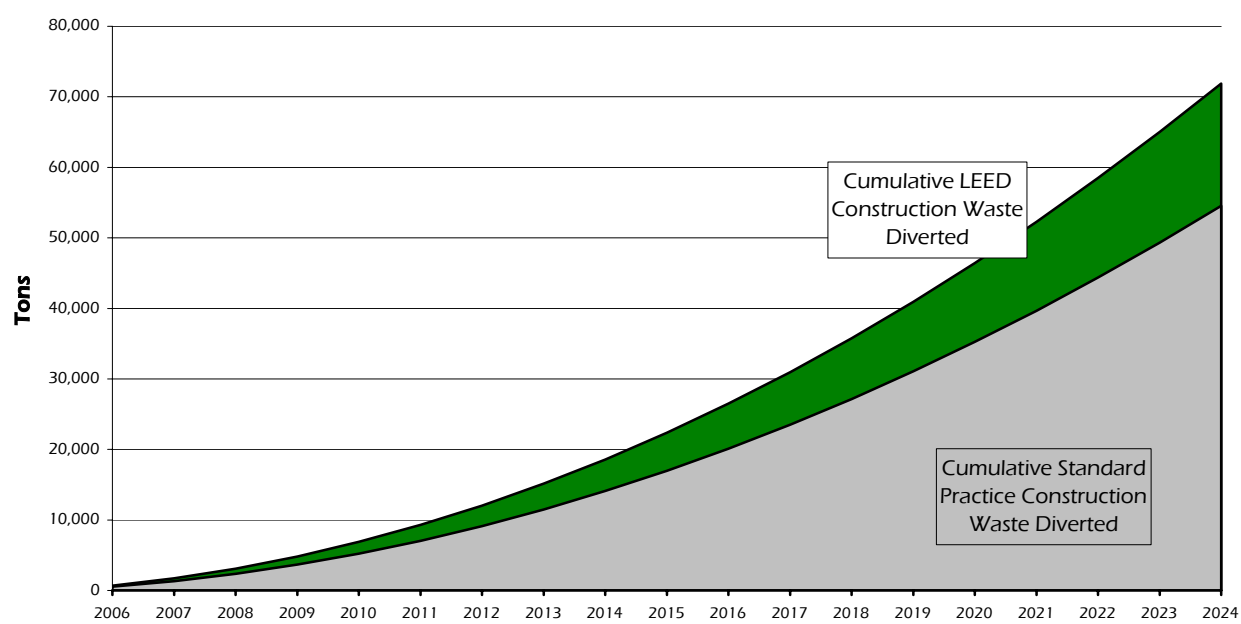
1 Based on 'King County C&D Waste Characterization and Recycling Industry Profile', Cascadia Consulting Group, Final Report 2002

2 Assumes that LEED Certified Commercial Construction will generate 24.4 lbs/SF on an average and divert 21.2 lbs/SF

Projected Annual Construction Waste for LEED Certified Commercial Construction in Seattle



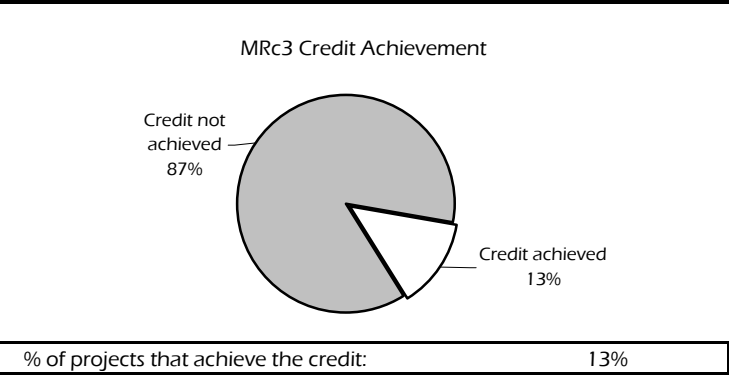
Projected Cumulative Construction Waste Diverted



MRc3 Resource Reuse

					Materials Reused						
Project		Building Area	Total Material Cost	Salvage Material Cost	% Resource Reuse	Furniture	Purlins & Columns	Doors & Frames	Tiles	Blinds	Rubble
		sqft	\$	\$	%	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N
	1 Public Health Sciences Building										
	2 Traugott Terrace										
	3 Seattle Pacific University Science Building										
	4 Seattle Central Library										
Y	5 Park 90/5 C	172,000	3,723,098	513,533	13.8	Y	Y	Y	N	N	Y
	6 High Point Community Center Addition										
	7 Fisher Pavilion										
	8 City of Seattle Justice Center										
	9 Carkeek Park Environmental Learning Center										
	10 Zimmer Gunsul Frasca Office										
	11 SBRI Building - Core & Shell										
Y	12 Park 90/5 A	100,000	247,385	50,300	20.33	Y	N	Y	Y	Y	N
	13 King Street Center										
	14 Nordheim Court Student Housing										
	15 Merrill Hall										
Total						2	1	2	1	1	1
% of Projects that implemented the strategy						100%	50%	100%	50%	50%	50%
Y	Credit achieved	2									
N	Credit not achieved	13									

Key Findings

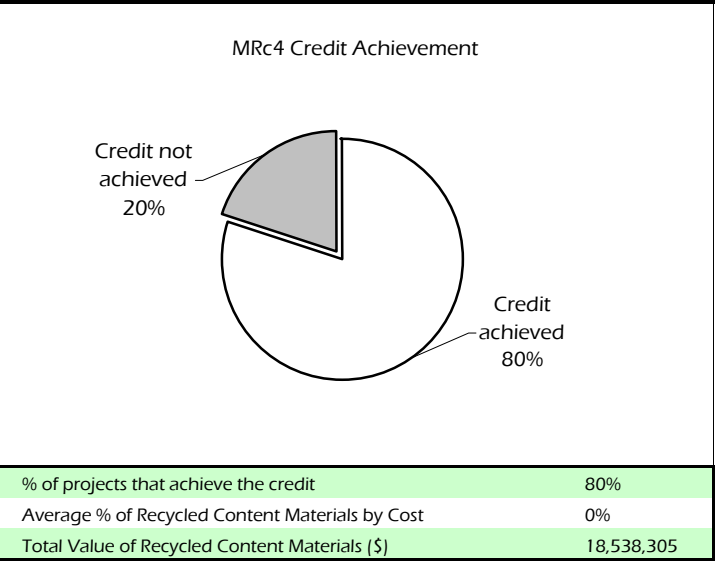




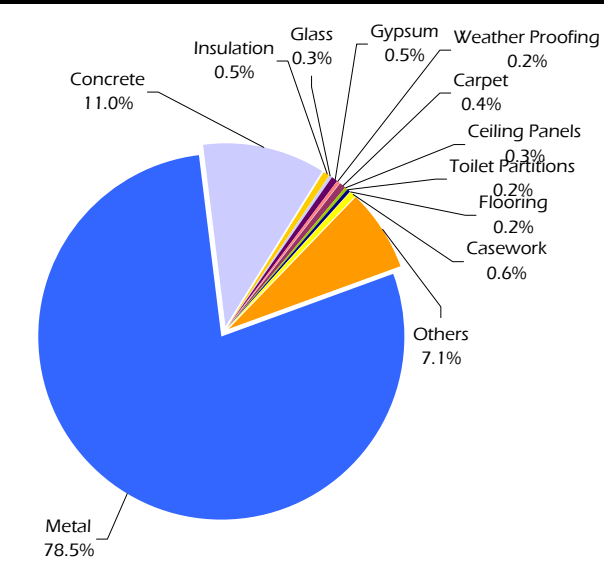
MRc4 Recycled Content Materials

								Recycled Content Material Value (PC + 1/2 PI) (\$)												
Project		Building Area	Total Material Cost	Recycled Content Value	% Recycled Content	% Post Industrial	% Post Consumer	Metal	Concrete	Insulation	Glass	Gypsum	Weather Proofing	Carpet	Ceiling Panels	Toilet Partitions	Flooring	Casework	Others	
		sqft	\$	\$	%	%	%	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Y	1 Public Health Sciences Building	372,000	11,977,470	2,418,044	20.2%	8.1	17.5	1,767,806	37,582	45,000	40,150	0	10,000	201	34,915	19,987	0	0	462,402	
Y	2 Traugott Terrace	38,483	1,067,651	98,873	9.3%	50.0	25.0	84,092	789	5,252	0	7,577	0	720	443	0	0	0	0	
Y	3 Seattle Pacific University Science Building	63,000	5,895,227	652,601	11.1%	3.6	9.3	483,269	0	7,692	0	10,265	0	20,623	21,885	0	3,600	105,267	0	
Y	4 Seattle Central Library	360,000	30,164,071	10,358,030	34.3%	15.2	26.8	8,131,541	1,967,793	0	0	10,265	0	0	0	0	0	0	248,431	
Y	5 Park 90/5 C	172,000	3,723,098	862,066	23.2%	5.0	25.5	754,133	0	0	12,412	0	0	11,071	0	12,528	7,313	0	64,610	
6 High Point Community Center Addition																				
Y	7 Fisher Pavilion	79,509	1,739,319	195,361	11.2%	4.8	8.9	99,641	9,252	0	4,254	0	22,579	160	0	6,846	42	0	52,587	
Y	8 City of Seattle Justice Center	298,000	34,814,826	2,781,371	8.0%	4.0	6.0	2,265,419	3,900	0	0	32,858	0	0	0	0	16,000	0	463,194	
9 Carkeek Park Environmental Learning Center																				
Y	10 Zimmer Gunsul Frasca Office	23,000	139,537	32,172	23.1%	25.2	10.5	13,039	0	1,306	308	6,931	0	0	873	0	0	0	9,716	
Y	11 SBRI Building - Core & Shell	112,000	5,748,823	772,918	13.4%	2.0	12.4	772,918	0	0	0	0	0	0	0	0	0	0	0	
Y	12 Park 90/5 A	100,000	247,385	31,611	12.8%	3.0	11.3	11,648	0	0	0	768	0	6,124	931	4,155	2,826	0	5,159	
13 King Street Center																				
Y	14 Nordheim Court Student Housing	403,000	4,596,895	258,782	5.6%			145,901	11,154	34,092	2,349	17,658	3,084	42,891	217	0	1,436	0	0	
Y	15 Merrill Hall	18,500	900,000	76,476	8.5%	5.3	7.6	31,335	919	3,809	4,606	6,400	7,016	277	936	1,097		6,310	13,772	
Totals		2,039,492	101,014,302	18,538,305	15.1%			14,560,742	2,031,389	97,151	64,079	92,722	42,679	82,067	60,200	44,613	31,217	111,577	1,319,870	
% of Projects that used recycled content material								100%	58%	50%	50%	67%	33%	67%	58%	42%	67%	17%	75%	
Y	Credit achieved	12	Number of Projects that used recycled content materials						12	7	6	6	8	4	8	7	5	8	2	9
N	Credit not achieved	3	% of Total Recycled Content Material Cost						79%	11%	1%	0%	1%	0%	0%	0%	0%	1%	7%	

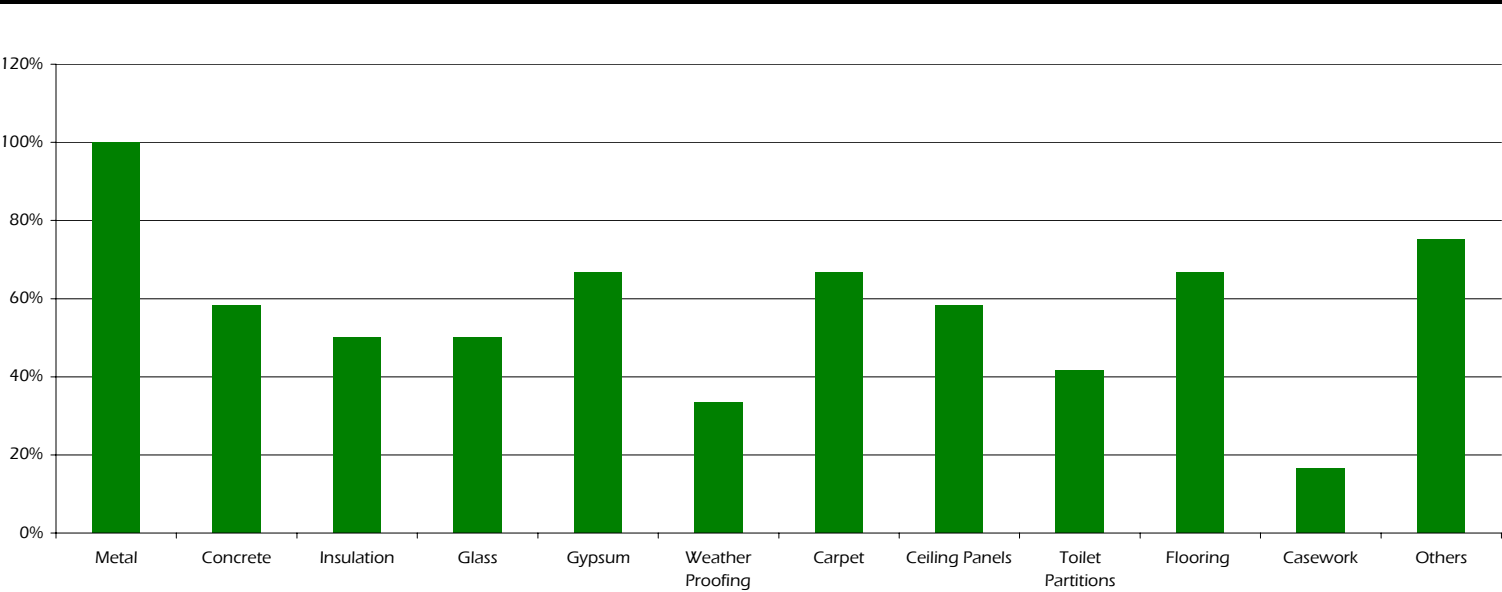
Key Findings



Recycled Content Material Cost



% of Projects Using Recycled Content Materials

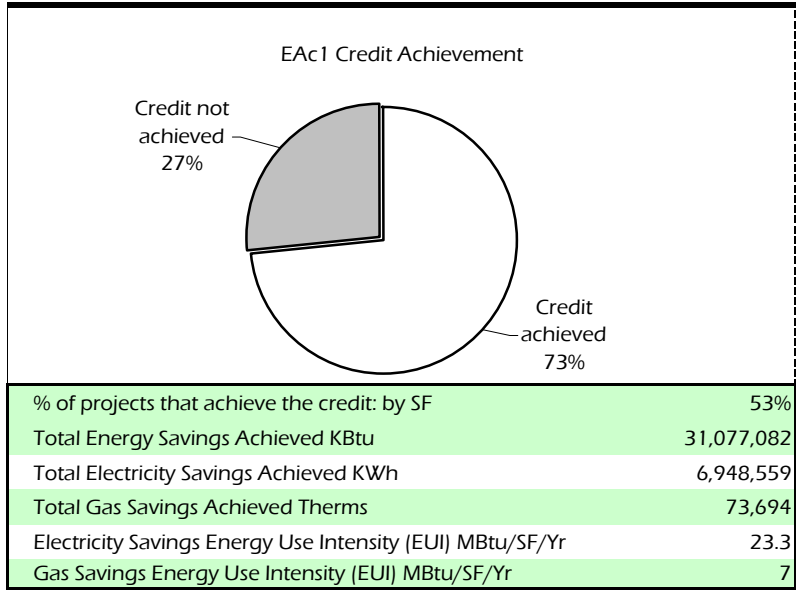


EAc1 Optimize Energy Performance

			Regulated Electricity			Regulated Gas			Savings relative to ASHRAE				
Project			ASHRAE 90.1-1999 Baseline		Savings relative to ASHRAE	ASHRAE 90.1-1999 Baseline		Savings Relative to ASHRAE	Total Savings	Electricity	Gas		
Building Area			kWh	kWh	kWh	Therms	Therms	Therms	1000* Btu	1000* Btu	1000* Btu		
sqft													
	1	Public Health Sciences Building											
Y	2	Traugott Terrace	38,483	293,984	231,018	62,966	58,400	41,835	16,565	1,870,949	214,849	1,656,100	
	3	Seattle Pacific University Science Building											
Y	4	Seattle Central Library	360,000	10,749,059	6,297,156	4,451,903	65,248	59,848	5,400	15,730,392	15,190,522	539,870	
Y	5	Park 90/5 C	172,000	1,895,291	1,334,060	561,231	6,454	6,201	253	1,940,300	1,915,000	25,300	
Y	6	High Point Community Center Addition <sup>1</sup>	na	na	na	na	na	na	na	na	na	na	
	7	Fisher Pavilion											
Y	8	City of Seattle Justice Center	298,000	4,766,743	3,076,983	1,689,760	66,773	59,185	7,588	6,524,300	5,765,700	758,600	
Y	9	Carkeek Park Environmental Learning Center	17,000	9,366	6,245	3,121	0	0	0	10,650	10,650	0	
	10	Zimmer Gunsul Frasca Office											
Y	11	SBRI Building - Core & Shell	112,000	1,584,795	1,449,681	135,114	53,058	9,440	43,618	4,821,781	461,028	4,360,753	
Y	12	Park 90/5 A											
Y	13	King Street Center											
Y	14	Nordheim Court Student Housing											
Y	15	Merill Hall	18,500	115,955	71,492	44,464	3,653	3,383	270	178,709	151,716	26,994	
Totals			1,015,983	19,415,193	12,466,634	6,948,559	253,586	179,892	73,694	31,077,082	23,709,465	7,367,617	
Average Total Energy Use Intensity (EUI) in Mbtu/sqft									30.59			23.34	7.25
Y	Credit achieved		11										
Y	Credit achieved but not included in this analysis <sup>2</sup>		4										
N	Credit not achieved		4										

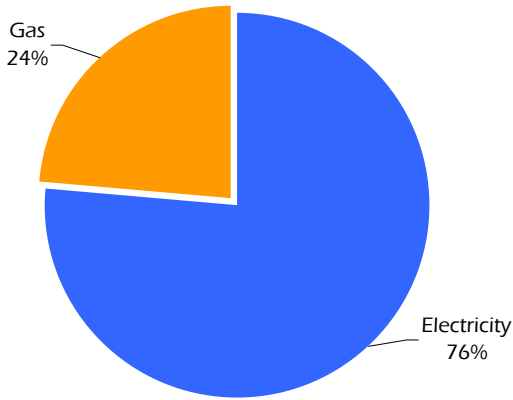
1 Data not available  
2 Only LEED NC and CS Certified projects data has been analyzed

Key Findings



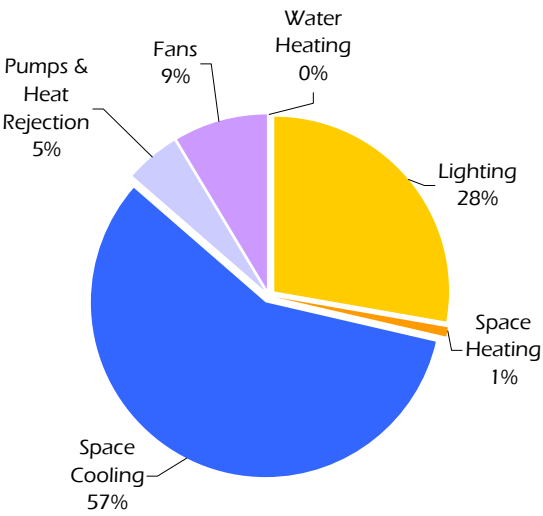
Regulated Loads Fuel Consumption

As Designed



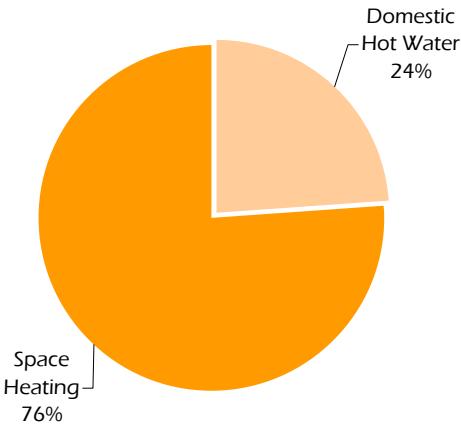
Electricity Savings by Enduse

As Designed



Natural Gas Savings by Enduse

As Designed

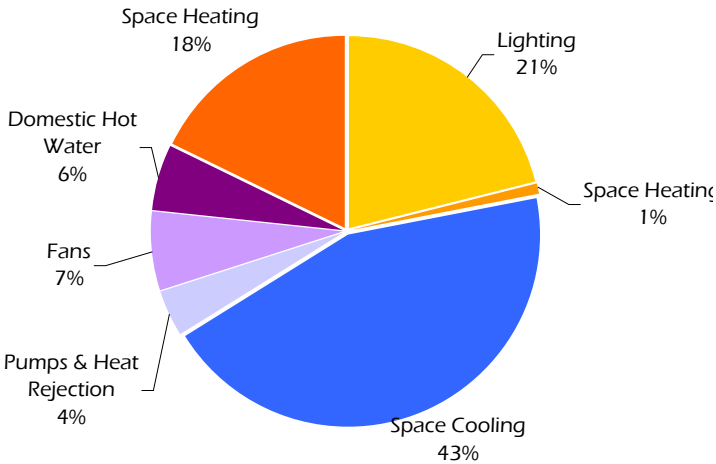




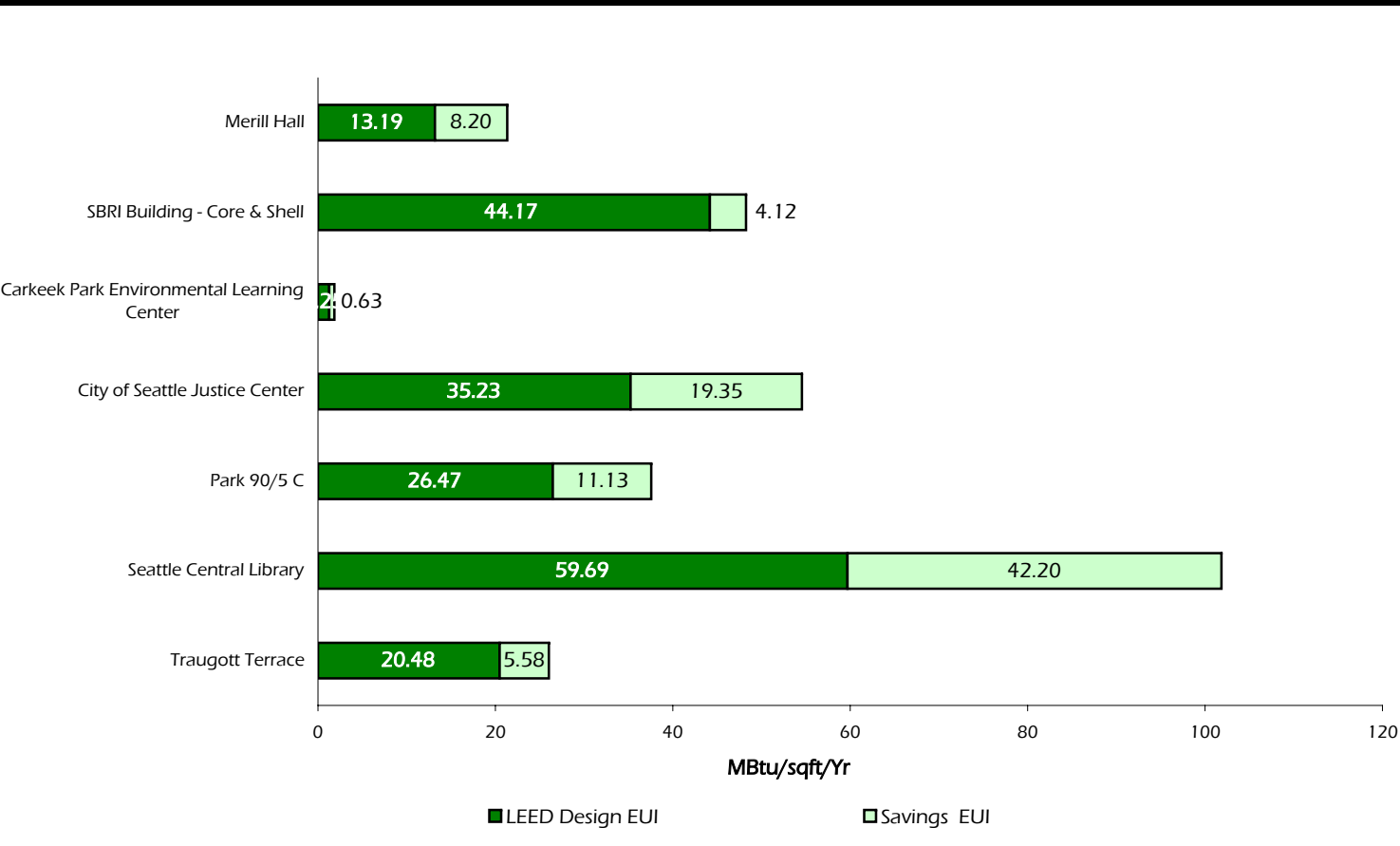
EAc1 Optimize Energy Performance *Continued*

		Regulated Electricity			Regulated Gas			Savings relative to ASHRAE		
Project		ASHRAE Baseline EUI	LEED Design EUI	Savings EUI	ASHRAE Baseline EUI	LEED Design EUI	Savings EUI	ASHRAE Baseline EUI	LEED Design EUI	Savings EUI
		MBtu/sqft	MBtu/sqft	MBtu/sqft	MBtu/sqft	MBtu/sqft	MBtu/sqft	MBtu/sqft	MBtu/sqft	MBtu/sqft
	1 Public Health Sciences Building									
Y	2 Traugott Terrace	26.07	20.48	5.58	151.72	108.68	43.03	177.79	129.17	48.62
	3 Seattle Pacific University Science Building									
Y	4 Seattle Central Library	101.88	59.69	42.20	18.12	16.62	1.50	120.00	76.31	43.70
Y	5 Park 90/5 C	37.60	26.47	11.13	3.75	3.60	0.15	41.35	30.07	11.28
Y	6 High Point Community Center Addition <sup>1</sup>									
	7 Fisher Pavilion									
Y	8 City of Seattle Justice Center	54.58	35.23	19.35	22.40	19.86	2.55	76.98	55.09	21.89
Y	9 Carkeek Park Environmental Learning Center	1.88	1.25	0.63	0.00	0.00	0.00	1.88	1.25	0.63
	10 Zimmer Gunsul Frasca Office									
Y	11 SBRI Building - Core & Shell	48.28	44.17	4.12	47.36	8.43	38.94	95.64	52.59	43.05
Y	12 Park 90/5 A									
Y	13 King Street Center									
Y	14 Nordheim Court Student Housing									
Y	15 Merrill Hall	21.39	13.19	8.20	19.74	18.28	1.46	41.13	31.47	9.66

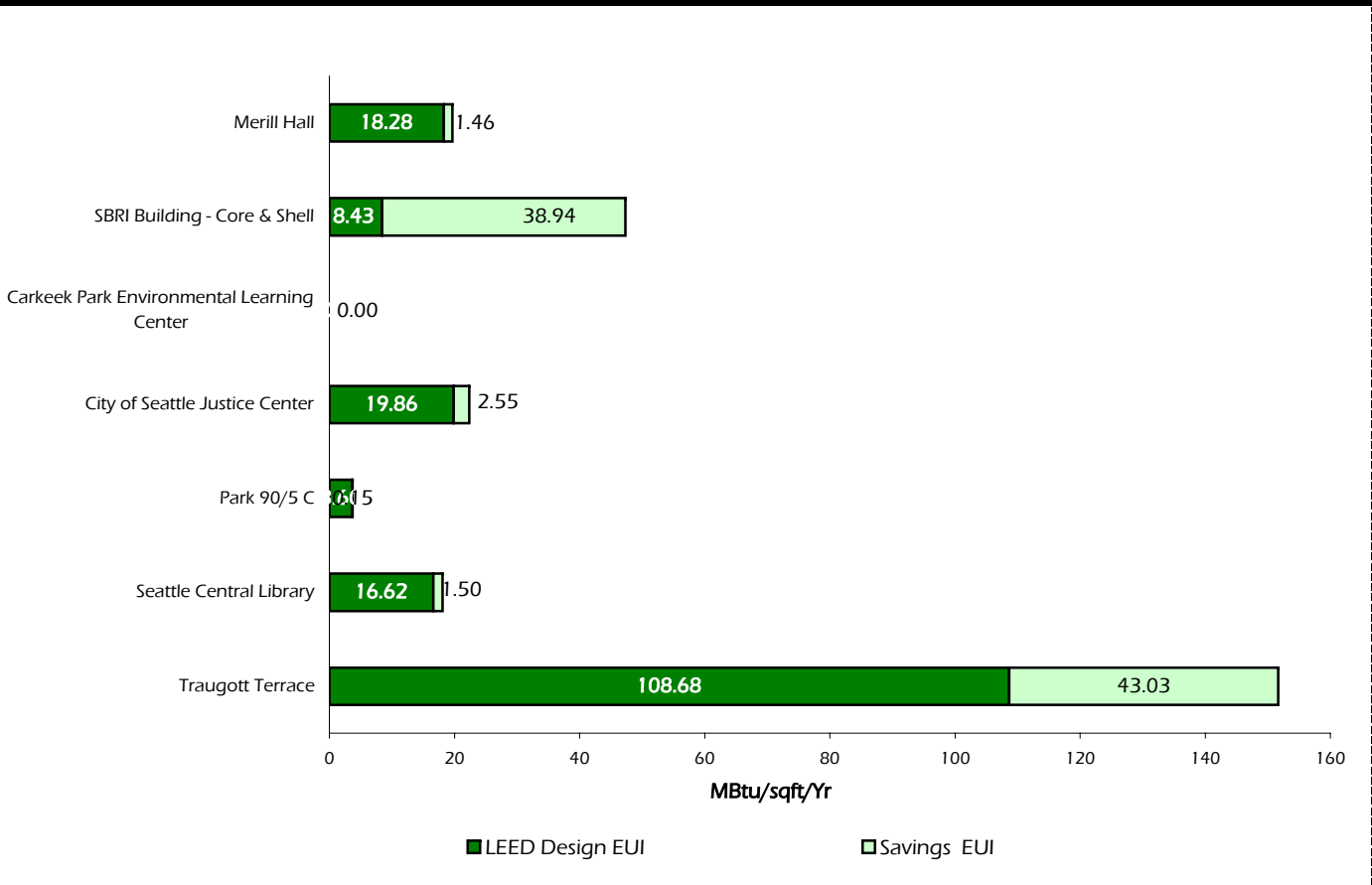
Total Energy Savings by Enduse



Electricity Energy Use Intensity for LEED NC Certified Projects in Seattle



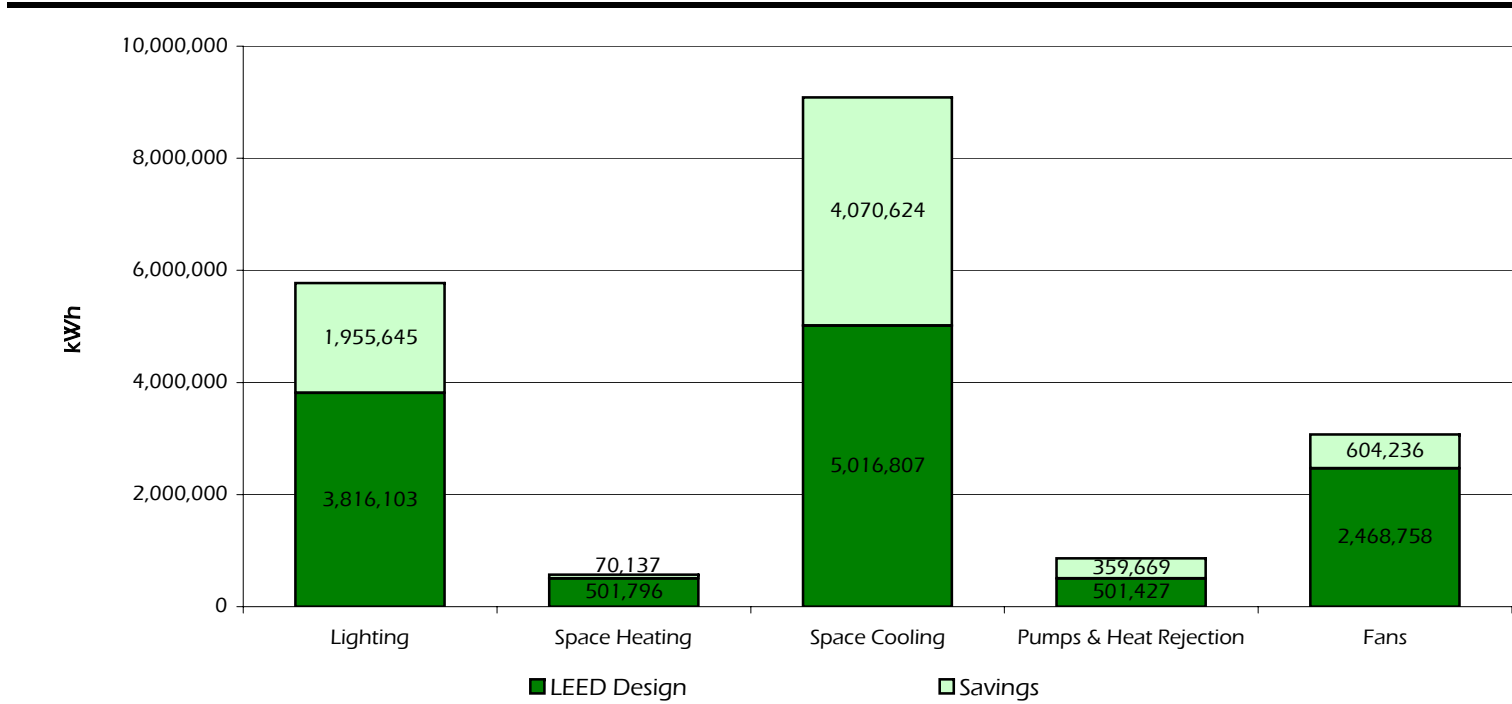
Gas Energy Use Intensity for LEED NC Certified Projects in Seattle



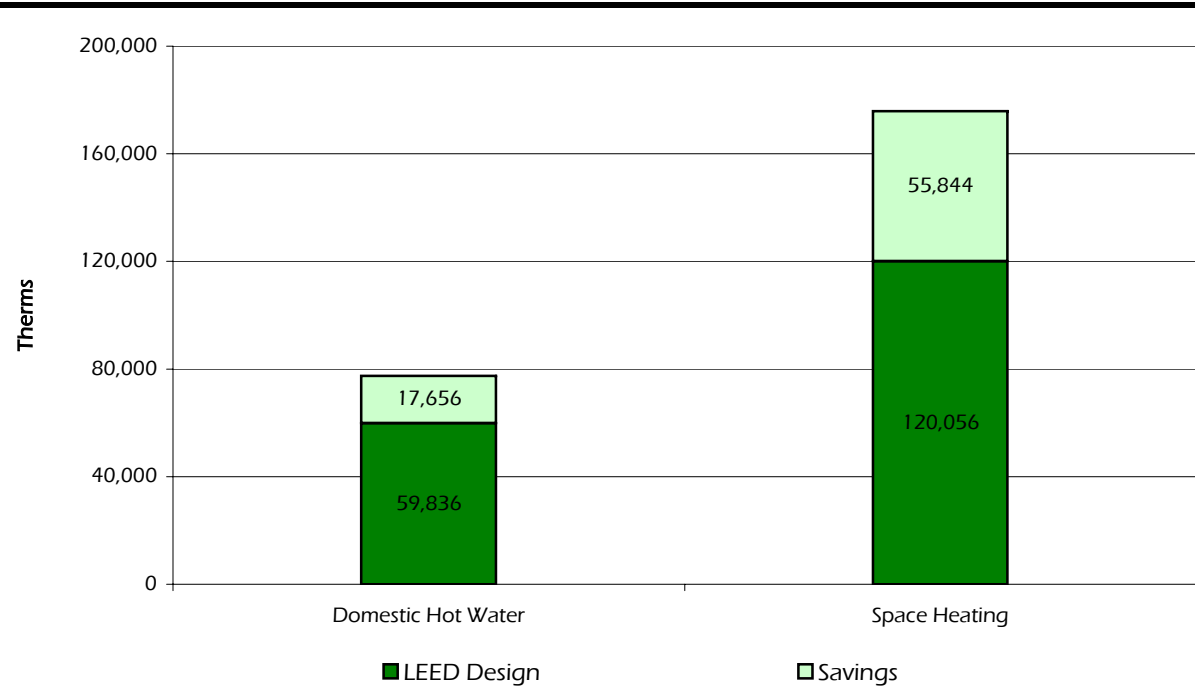
EAc1 Optimize Energy Performance *Continued*

		Electricity (kWh)												Gas (Therms)			
Project		Lighting		Space Heating		Space Cooling		Pumps & Heat Rejection		Fans		Water Heating		Domestic Hot Water		Space Heating	
		LEED Design	Savings	LEED Design	Savings	LEED Design	Savings	LEED Design	Savings	LEED Design	Savings	LEED Design	Savings	LEED Design	Savings	LEED Design	Savings
	1 Public Health Sciences Building																
Y	2 Traugott Terrace	121,331	6,222	77,029	53,504	900	250	16,044	1,770	15,714	1,220	0	0	41,835	16,565	0	0
	3 Seattle Pacific University Science Building																
Y	4 Seattle Central Library	1,623,896	794,956	0	0	4,294,026	3,659,948	16,108	38,722	363,126	41,723	0	0	6568	0	53280	5400
Y	5 Park 90/5 C	651,204	409,713	259,954	4,982	134,227	54,511	1,172	0	287,503	92,024	0	0	4,951	0	1,250	260
Y	6 High Point Community Center Addition <sup>1</sup>																
	7 Fisher Pavilion																
Y	8 City of Seattle Justice Center	925,138	613,896	35,784	-5,275	419,619	262,240	402,650	334,277	1,293,792	484,622	0	0	4,395	787	54,790	6801
Y	9 Carkeek Park Environmental Learning Center	3,350	1310	1883	1811	0	0	203	0	303	0	506	0	0	0	0	0
	10 Zimmer Gunsul Frasca Office																
Y	11 SBRI Building - Core & Shell	449,897	106,288	127,146	15,115	160,119	86,533	61,666	-15,568	489,599	-29,222	0	0	1,323	235	8,117	43,383
Y	12 Park 90/5 A																
Y	13 King Street Center																
Y	14 Nordheim Court Student Housing																
Y	15 Merrill Hall	41,288	23,260	0	0	7,916	7,142	3,583	468	18,722	13,868	0	0	764	69	2,619	201
Total		3,816,103	1,955,645	501,796	70,137	5,016,807	4,070,624	501,427	359,669	2,468,758	604,236	506	0	59,836	17,656	120,056	55,844
Total Savings (Mbtu)		6,672,937		239,316		13,889,545		1,227,243		2,061,739		0		1,765,193		5,583,029	

Total Regulated Electricity Use and Savings Relative to ASHRAE Standard 90.1-1999



Total Regulated Gas Use and Savings Relative to ASHRAE Standard 90.1-1999



EA c1 Energy Savings Projections

Assumptions

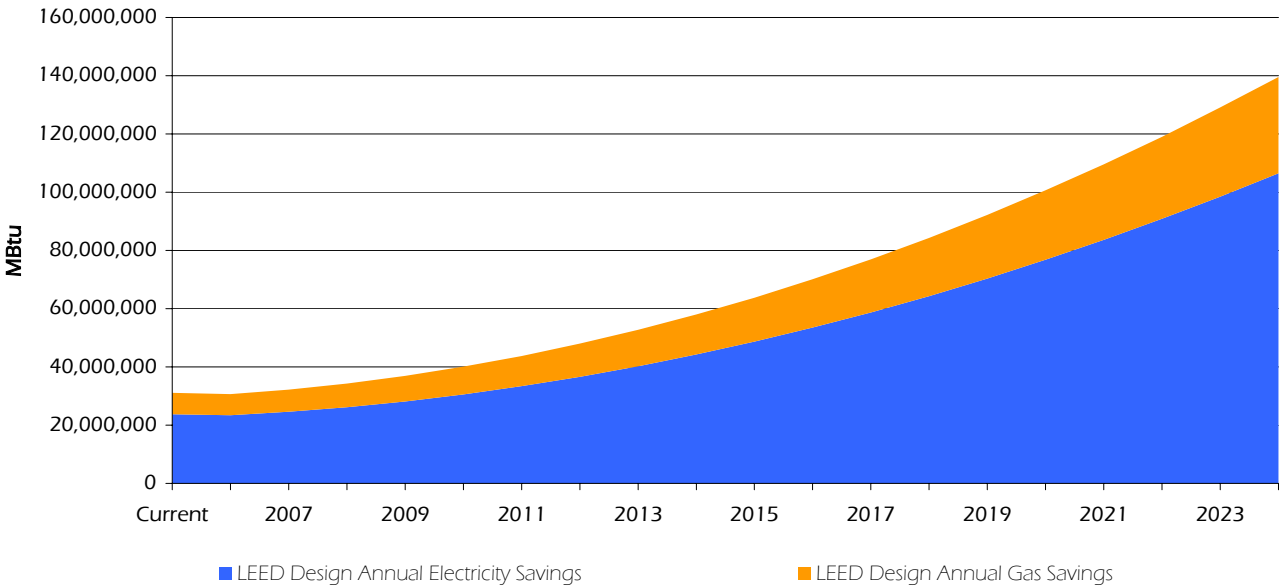
Based on Compliance Plan 2004 and LEED WEc3 Analysis for Seattle Projects	
Projected Annual New Commercial Construction in Seattle	1,298,10 6 SF
Electricity Savings Energy Use Intensity (EUI) MBtu/SF/Yr	23
Gas Savings Energy Use Intensity (EUI) MBtu/SF/Yr	7.3
% SF of LEED New Construction Certified Projects that achieved EA c1	53%

Projected Energy Savings Relative to ASHRAE 90.1-1999 for Future LEED Certified Projects

	SF of LEED Commercial Construction	% Commercial New Construction Adopting LEED	LEED Design Annual Electricity Savings	LEED Design Annual Gas Savings	LEED Design Cumulative Electricity Savings	LEED Design Cumulative Gas Savings	LEED Design Cumulative Energy Savings
	Sq.ft.		Mbtu	Mbtu	Mbtu	Mbtu	Mbtu
Current	1,822,992		23,709,465	7,367,617	23,709,465	7,367,617	31,077,082
2006	1,887,897	5%	23,364,402	7,260,391	47,073,867	14,628,008	92,778,957
2007	1,985,255	8%	24,569,293	7,634,805	71,643,160	22,262,813	186,684,930
2008	2,115,066	10%	26,175,815	8,134,025	97,818,975	30,396,839	314,900,744
2009	2,277,329	13%	28,183,967	8,758,050	126,002,941	39,154,889	480,058,573
2010	2,472,045	15%	30,593,749	9,506,880	156,596,690	48,661,769	685,317,032
2011	2,699,214	18%	33,405,161	10,380,515	190,001,851	59,042,283	934,361,167
2012	2,958,835	20%	36,618,204	11,378,954	226,620,056	70,421,238	1,231,402,460
2013	3,250,909	23%	40,232,878	12,502,199	266,852,933	82,923,437	1,581,178,830
2014	3,575,435	25%	44,249,182	13,750,249	311,102,115	96,673,686	1,988,954,631
2015	3,932,415	28%	48,667,116	15,123,103	359,769,231	111,796,789	2,460,520,651
2016	4,321,847	30%	53,486,680	16,620,763	413,255,911	128,417,552	3,002,194,113
2017	4,743,731	33%	58,707,875	18,243,227	471,963,786	146,660,779	3,620,818,679
2018	5,198,068	35%	64,330,700	19,990,497	536,294,486	166,651,276	4,323,764,441
2019	5,684,858	38%	70,355,156	21,862,571	606,649,642	188,513,848	5,118,927,931
2020	6,204,101	40%	76,781,242	23,859,451	683,430,884	212,373,299	6,014,732,114
2021	6,755,796	43%	83,608,958	25,981,135	767,039,843	238,354,434	7,020,126,391
2022	7,339,944	45%	90,838,305	28,227,625	857,878,148	266,582,059	8,144,586,597
2023	7,956,544	48%	98,469,282	30,598,919	956,347,430	297,180,978	9,398,115,005
2024	8,605,597	50%	106,501,890	33,095,018	1,062,849,320	330,275,996	10,791,240,321

1. The local energy code is more stringent than ASHRAE Stanadard 90.1-1999 and therefore the actual savings due to LEED may be lower than the projected benefits.
2. Assumes that 53% of the certified commercial construction will achieve the credit and on an average save 23 MBtu/SF/Yr of Electricity and 7 MBtu/SF/Yr of gas relative to ASHRAE Standard 90.1-1999

Projected Total Annual Energy Savings for LEED Certified Commercial Construction in Seattle



Projected Cumulative Energy Savings for LEED Certified Commercial Construction in Seattle

